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# LONDON LUTON AIRPORT

NOISE CONTOUR LIMITS: TRANSITIONAL ARRANGEMENT

PLANNING CONDITION 12 : PAST AND FUTURE NOISE

L.A. Ref: 12/01400/FUL

BAP Ref: A9501-R06D//A11060/04/R01

# DRAFT FOR DISCUSSION

Report to

London Luton Airport Operations Ltd
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## 1.0 INTRODUCTION

Planning consent was granted in June 2014 by Luton Borough Council (LBC) to application 12/01400/FUL submitted by London Luton Airport Operations Ltd (LLAOL) to provide facilities to accommodate increased passenger activity by 2028. The consent was subject to the imposition of certain planning conditions with respect to several matters including noise. Noise was directly addressed in Planning Conditions 11, 12, 13 and 14. Planning Condition 10 limits the commercial passenger throughput of the Airport to 18mppa.

LLAOL submitted a detailed report to discharge Planning Conditions 11, 12, 13 and 14. This was approved by LBC on the 2nd March 2015. In light of that the new noise contour limits given in Condition 12 became effective in September 2015 (6 months after approval of the Noise Control Scheme).

LLAOL and London Luton Airport Ltd (LLAL) have also entered into a Section 106 Town and Country Planning Act 1990 (as amended) Agreement with LBC which includes obligations with respect to noise, given in Schedule 1 Noise Mitigation of the agreement. The Section 106 Agreement requires LLAOL to submit a draft Noise Management Plan, a draft Residential Noise Insulation Scheme and a draft Non-Residential Noise Insulation Scheme to LBC for approval. These have been submitted to LBC. It also required LLAOL to operate a Noise Violation Penalty System.

Separate to these matters the Airport operates, in accordance with The Environmental Noise (England) Regulations 2006, a Noise Action Plan (NAP) approved by the Department for Transport (DfT) and the Department for Environment, Food and Rural Affairs (Defra). The current approved NAP includes 55 noise related measures. The Airport also operates in accordance with the Luton Byelaws approved by the Secretary of State for Transport.

LLAOL in accordance with their approved Noise Action Plan actions 16 and 18, reduced the existing noise violation limits on the 1st April 2015 to 80 dB(A) during the night-time period (23.00 – 06.59) and 82 dB(A) during the daytime period (07.00 – 22.59). LLAOL have sought a variation to Planning Condition 11i with respect to new violation limits as those in Condition 11i were found inappropriate. LLAOL proposed continuing their well-established policy of staged reduction in noise violation limits. LLAOL have been advised by the planning authority that the variation sought is accepted.

This report assesses future noise w.r.t meeting the initial noise contour area limits set in planning Condition 12 whilst the introduction at Luton of the new quieter re-engined single aisle narrow bodied transport aircraft (i.e. Airbus A320neo family, Boeing 737 MAX family) is awaited. This arises as services requested at the Airport have risen at a much greater rate than envisaged in 2012 when the Environmental Statement (E.S.) for the provision of facilities to accommodate increased passenger was developed.

This report explains in Section 2.0 the noise contour limits that have operated at Luton Airport since 1998, and in Section 3.0 the past actual noise contours for the daytime and night-time periods are described for the years 2010 – 2015. Section 4.0 presents the current activity and future forecasts, and the resultant noise contours for 2016 onwards to 2028.

In Section 5.0 the conflict between the now forecast future noise contours and the initial limits specified in Planning Condition 12 are discussed. Section 6.0 proposes transitional arrangements to address the forecast conflict. The conclusions are brought together in Section 7.0 with related technical information provided in the attached appendices. Appendix 1 provides a glossary of acoustic and aeronautical terminology.

## 2.0 PLANNING CONDITION 12

Condition 12 set out in the planning permission notice is given below.

**“12**

**The area enclosed by the 57dB(A) Leq16hr (0700-2300), contour shall not exceed 19.4 sq km for daytime noise, and the area enclosed by the 48dB(A) Leq8hr (2300-0700) contour shall not exceed 37.2 sq km for the night-time noise, when calculated by the Federal Aviation Authority Integrated Noise Model version 7.0.d (or as may be updated or amended).**

**Within five years of the commencement of development a strategy shall be submitted to the Local Planning Authority for their approval which defines the methods to be used by LLAOL or any successor or airport operator to reduce the area of the noise contours by 2028 for daytime noise to 15.2 km2 for the area exposed to 57dB Leq16hr (0700-2300) and above and for night-time noise to 31.6 km2 for the area exposed to 48 dB(A) Leq8hr (2300-0700) and above.**

**From the 1st January 2014 forecast aircraft movements and consequential noise contours (Day, Night and Quota Periods) for the forthcoming calendar year shall be reported on the 1st December each year to the Local Planning Authority, which shall utilise the standard 92 day summer contour.”**

This report addresses the first paragraph of Condition 12; less difficulty is currently envisaged with satisfying the condition with respect to noise in 2028 or in annual reporting.

## 2.1 Recent Noise Contour Limits

In the period from 1998 to the implementation of the recent planning permission (L.A. Ref: 12/01400/FUL/June 2014) the Airport operated within the noise contour limits set in the planning conditions related to the earlier development. Tables 1 and 2 record those limits, specifically that not to be exceeded, and that which if expected to be exceeded would require noise actions to be taken. Table 1 considers daytime noise, 07.00-23.00, and Table 2 night-time 23.00-07.00. Also shown are the new limits set by Planning Condition 12.

| **Table 1 Noise Contour Area Limits at Luton Airport Daytime Area exposed to 57 dB $L_{Aeq,16h}$ and above ($km^2$)** | |
|---|---|
| 1998 to 2014 Noise Contour Limits | |
| Not to be exceeded (1984 value) | 31.52 |
| Need for noise reduction plan (1999 predicted values) | 19.60 |
| Condition 12 Limits (from 2014 permission) | |
| Not to be exceeded | 19.40 |
| To be sought by 2028 | 15.20 |
| Recent range of Areas (2010-2016) | (12.8-19.2)[(1)] |

[(1)] Daytime/Night-time noise contour areas are tabulated in Appendix 2 (Table A2.1)

| **Table 2 Noise Contour Area Limits at Luton Airport Night-time Area exposed to 48 dB $L_{Aeq,8h}$ and above ($km^2$)** | |
|---|---|
| 1998 to 2014 Noise Contour Limits | |
| Not to be exceeded (1984 value) | 85.04 |
| Need for noise reduction plan (1999 predicted values) | 60.6 |
| Condition 12 Limits (from 2014 permission) | |
| Not to be exceeded | 37.2 |
| To be sought by 2028 | 31.6 |
| Recent range of Areas (2010-2016) | (30.1-36.5)[(1)] |

[(1)] Daytime/Night-time noise contour areas are tabulated in Appendix 2 (Table A2.1)

## 2.2 New Noise Contour Limits: Planning Condition 12 (L.A. Ref: 12/01400/FUL)

Tables 1 and 2 above show the noise contour area limits arising from Planning Condition 12. Also given is the range of recent noise contour areas for the period 2010-2016. Table 3 summarizes briefly the Airport activity in that period, and in 2016.

**Table 3 Luton Airport Activity (Annual) [(1)]**

| YEAR | Passengers Served (mppa) | Aircraft Movements | | | |
|---|---|---|---|---|---|
| | | Cargo | Passenger[(2)] | G.A.[(3)] | TOTAL (1,000s) |
| 2010 | 8.8 | 1609 | 71,983 | 16,298 | 95.6 |
| 2011 | 9.5 | 1722 | 75,278 | 16,480 | 99.3 |
| 2012 | 9.6 | 1816 | 74,976 | 16,111 | 98.8 |
| 2013 | 9.7 | 1718 | 74,071 | 15,919 | 97.6 |
| 2014 | 10.5 | 1695 | 79,171 | 16,831 | 103.9 |
| 2015 | 12.3 | 1704 | 91,154 | 16,370 | 116.4 |
| 2016 | 14.6 | 1790 | 104,802 | 19,120 | 131.4 |

[(1)] LLA Statistics
[(2)] Includes commercial flights by executive aircraft
[(3)] G.A includes Private Aircraft, Helicopters and Business Jets not operating for hire or reward
[(4)] Daytime/Night-time noise contour areas are tabulated in Appendix 2 (Table A2.1)

The Airport has recently seen an unprecedented demand for air travel. For instance the growth in passengers served was 18.5 % year on year for 2016, in April 2017 16.1% increase.

With respect to the new contour area limits they were set by the planning authority, taking into account the information provided in the Environmental Statement of November 2012, see Table 4 below.

**Table 4 Noise Contour Areas (from ES November 2012)**

| Scenario Forecasts for 2028 | Daytime Contour 57 dB $L_{Aeq,16h}$ | Night-time Contour 48 dB $L_{Aeq,8h}$ |
|---|---|---|
| Without fleet modernisation | | |
| Without development (12.4mppa) | 18.2 km$^2$ | 38.92 km$^2$ |
| With development (18mppa) | 23.72 km$^2$ | 48.02 km$^2$ |
| ALSO With partial fleet modernisation | | |
| Without development (12.4mppa) | 15.22 km$^2$ | 32.32 km$^2$ |
| With development (18mppa) | 19.52 km$^2$ | 40.42 km$^2$ |

The forecasts for the E.S. were made several years ago, and could not have taken into account the recent unprecedented traffic increase; the forecast made in 2012 indicated about 11mppa in 2015 not the 12.3mppa which actually were served. In 2016 the throughput was 14.6mppa, not 11.5mppa as forecast in 2012. The latest forecasts suggest throughputs of about 16.6mppa in 2018, with 18mppa reached by 2020.

## 3.0 PAST NOISE CONTOURS [2010-2015]

During the period 2010-2015 the Airport has increased the passengers served by about 40%, with annual air transport movements increasing by 33%. In the same period the total annual aircraft movements have increased from about 96,000 to 116,000. The main aircraft types have remained similar in the last six years, see Table 5 below.

**Table 5 Summary of Main Passenger Aircraft Types at Luton Airport and Activity**

| Aircraft Type | ANNUAL MOVEMENTS IN YEAR | | | | | |
|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Airbus A319 | 16,853 | 26,062 | 26,802 | 25,751 | 25,120 | 26,554 |
| Airbus A320 | 17,434 | 21,496 | 24,289 | 25,412 | 30,429 | 39,395 |
| Airbus A321 | 2,163 | 2,208 | 2,121 | 1,982 | 2,562 | 2,667 |
| Boeing 737-400 | 302 | 640 | 1,046 | 844 | 992 | 924 |
| Boeing 737-800 | 10,256 | 10,843 | 10,720 | 11,007 | 10,673 | 12,093 |

In essence, the passenger activity is currently dominated by operations of the Airbus A319 and Airbus A320 aircraft. The earlier E.S. forecasts for 2028 indicated continued domination of the passenger aircraft by this size of aircraft, and the current forecasts for 2028 concur.

During the period, 2010-2015, the area exposed to the daytime level, 57 dB $L_{Aeq,16h}$ and above, has increased from around 13 to 17 $km^2$. The night time area exposed to 48 dB $L_{Aeq,8h}$ has increased from around 30 to 35 $km^2$. Appendix 2 provides detailed information of the contour methodology and contours for recent contouring based on actual movements.

Figure 1 shows the daytime noise contours at 57 dB $L_{Aeq,16h}$ for 2011 and 2015. Figure 2 shows the corresponding contours for the night-time level of 48 dB $L_{Aeq,8h}$.

The daytime noise impacted areas, Figure 1, delineated by the contours 57 dB $L_{Aeq,16h}$ and above range in 2011 from the rural area near St. Paul's Walden to the east of the airport, to areas near the M1 in Slip End to the west of the airport. The contours include parts of Breachwood Green and South Luton. These areas have been exposed to such noise for many years. There were approximately 6,700 people resident in the areas covered by the 2011 57 dB $L_{Aeq,16h}$ contour.

The residents in the area of South Luton adjoining the busy west-bound departure route are exposed to the highest levels. That includes the redeveloped school at Capability Green. There are no hospitals within these daytime contours.

The size of the noise impacted area at night, Figure 2, delineated by the contours 48 dB $L_{Aeq,8h}$ and above is greater than during the day. The 2011 contour stretches from Stevenage, to west of Caddington, and to south of Markyate and Flamstead, see Figure 2. This area has been exposed to such noise for many years. The largest residential area impacted at night is in South Luton. There are approximately 16,400 people resident in the areas covered by the 48 dB $L_{Aeq,8h}$ contour.

In the period from 2011, the Airport activity has grown, e.g. passengers served have grown from 9.5mppa to 12.3mppa. The daytime and night contours (2015) have consequentially grown. For instance the area of the 57 dB $L_{Aeq,16h}$ daytime contour has increased from 12.8 to 17.2 $km^2$.

The daytime noise impacted area has grown but in 2015 still occupied the area from the rural area near St. Paul's Walden to the Airport on the eastern side. On the western side the contour has extended further south of Slip End and also approaches the A5 between Markyate and Flamstead.

The population within the daytime impacted area, 57 dB $L_{Aeq,16h}$ and above, has increased from approximately 6,700 to 7,100. However the population within the night-time impacted area, 48 dB $L_{Aeq,8h}$ and above, has decreased from approximately 16,300 to 14,700. This reduction in the population within the night-time contour arises despite an overall increase in area and is due to the shape of the contour changing. In particular the contour for 2015 is longer but generally thinner than the contour for 2011, see Figure 2. It therefore contains less of South Luton where much of the population is located.

The cause of the change in contour shape is attributed to the improved validation used to produce the contours for 2015, see Appendix 2. This allowed for measured results in South Luton which found the earlier contour methodology over predicted the noise levels in that area.

During the period of growth, 29% in passenger activity, the following changes have arisen;

> 6% increase in population within noise impacted area (daytime)

> 10% decrease in population within noise impacted area (night-time) [(1)]

| > Increase in noise | Daytime ($L_{Aeq,16h}$) | Night-time ($L_{Aeq,8h}$) |
|---|---|---|
| East of Airport | | |
| Breachwood Green | +2 dB | 0 dB |
| St. Pauls Walden | +2 dB | +0.5 dB |
| West of Airport | | |
| Luton (South East) | -1 dB | -1 dB |
| Caddington | +2 dB | 0 dB |

[(1)] This comparison will be confused by the improved validation used for 2015 contours.

In summary during the period 2010-2015 the Airport has increased the passengers served by about 40% with the total annual aircraft movements increasing from about 95,000 to 114,000. The main aircraft types have remained similar with passenger activity currently dominated by operations of the Airbus A319 and Airbus A320 aircraft.

With the increase in activity there has been growth in the daytime and night-time contour areas. Considering the noise impacted areas these indicate, from 2011 when the contours were smallest, that there has been a 6% increase in daytime impacted population but a 10% decrease in night-time impacted population. This reduction in the night-time population is attributed to the updated validation of the 2015 contours. For selected locations east and west of the airport small changes in noise are found, with particularly those at night so small they are not considered significant.

## 4.0 CURRENT AND FUTURE NOISE CONTOURS [2016-2028]

In 2012, forecasts were made of the activity at Luton Airport in the period 2013-2031. Subsequently the DfT published in January 2013 its forecasts for Luton Airport. Table 6 brings together the DfT forecasts with those prepared for the E.S. The latest forecast by LLAOL, in line with the unprecedented traffic growth currently being experienced at several UK airports including Luton, is discussed below. Appendix 3 contains further information on the latest future forecasts.

| Table 6 Forecast Future Activity at Luton Airport | | | |
|---|---|---|---|
| **Year** | **Million Passengers per Annum** | **Air Traffic Movements (000's)** | **Air Transport Movements (000's)** |
| 2015 (E.S.)[1] | 11.2 | 118 | ? |
| 2015 (Act) | 12 3 | ≈ 117 | ≈ 97 |
| 2020 (E.S.)[1] | 13.4 | 132 | |
| 2020 (DfT)[2] | 9.2 | | - |
| 2020 (DfT)[3] | 13.8 | 96.7 | - |
| 2025 (E.S.)[1] | 16.6 | 150 | - |
| 2028 (E.S.)[1] | 17.8 | 157 | - |
| 2030 (E.S.)[1] | 17.8 | 157 | - |
| 2030 (DfT)[2] | 13.9 | | - |
| 2030 (DfT)[3] | 18.5 | 133.7 | - |
| 2030 (DfT)[4] | 15.2-18.5 | 109-135 | - |

(1) Environmental Statement, Table 3.3: Upper end passenger and associated air traffic movements unconstrained demand forecasts for the Airport (2012).

(2) DfT: UK Aviation Forecasts: January 2013: Annex D.8. Terminal passenger forecasts, central demand case, 2010-2050 (unconstrained).

(3) DfT: UK Aviation Forecasts: January 2013: Annex E.2. Terminal passenger forecasts, central demand case, 2011-2050 (constrained).

(4) DfT: UK Aviation Forecasts: January 2013: Annex E.3. Terminal passenger, forecast range, 2030 and 2050 (constrained).

In 2015 the growth in the number of passengers served by three of the main resident airlines was exceptional, i.e. easyJet +15%, Ryanair +28%, and Wizz Air +28%.

In 2016 a year on year growth of 18.5 % occurred. A further 7.5% annual growth has been conservatively assessed for 2017, but growth in the first four months has exceeded 17%. It is currently forecast that growth will continue, due to commitments from several new airlines, and growth already advised by resident airlines. That is before most of the current aircraft have been replaced by re-engined quieter aircraft. Table A3.4 presents a summary of first flights and delivery dates for some of the re-engined aircraft; Section 4.2 reviews fleet modernization projections. It is expected that easyJet will receive a small number of re-engined aircraft this year, Airbus A320 neo types. The manufacturer delivered the first 68 aircraft of this new type in 2016, worldwide, for the A320 neo alone the manufacturer has currently over 3500 orders to fulfil. In the first five months of 2017, a further 48 A320neo aircraft have been delivered. One was delivered to EasyJet at Luton in June 2017.

## 4.1 Current 2016 Noise

Figures 3 and 4 illustrate the noise arising from the recent (2016) summer activity. Table 7 notes the area of the noise contours and the population so exposed.

The contours, in general, repeat the shape of past contours indicating that the areas exposed to noise are those affected in the past. In summer 2016 no re-engined aircraft operated services at Luton Airport.

**Table 7 Airborne Aircraft Noise: Summer 2016**

| Parameter | Daytime | Night-time |
|---|---|---|
| Noise Contours | | |
| Contour Area 57 dB $L_{Aeq,16h}$ | 19.2 km$^2$ | n/a |
| Contour Area 48 dB $L_{Aeq,8h}$ | n/a | 36.5 km$^2$ |
| Population | | |
| 66 – 69 dB $L_{Aeq,T}$ | <100 | - |
| 63 – 66 dB $L_{Aeq,T}$ | 700 | - |
| 60 – 63 dB $L_{Aeq,T}$ | 1,500 | - |
| 57 – 60 dB $L_{Aeq,T}$ | 5,000 | 1,100 |
| 54 – 57 dB $L_{Aeq,T}$ | - | 1,800 |
| 51 – 54 dB $L_{Aeq,T}$ | - | 4,700 |
| 48 – 51 dB $L_{Aeq,T}$ | - | 6,900 |

The population within the daytime impacted area, 57 dB $L_{Aeq,16h}$ and above, is now about 7,200, very slightly more than in 2015. The night-time noise contour, 48 dB $L_{Aeq,8h}$ and above currently contains about 14,500 people very slightly less than in 2015. Table 13 illustrates the daytime noise levels at several locations in 2016. Table 14 notes the population exposure in various noise bands from 57 up to over 69 dB $L_{Aeq,16h}$.

The daytime contour area is very close to the initial Condition 12 limit, i.e. 19.2 km$^2$ actual: limit 19.4 km$^2$. At night the contour area is now 36.5 km$^2$, 0.7 km$^2$ less than the initial limit.

The provisional forecast for this year suggests a daytime contour area of 20.7 km$^2$ and a night-time contour area of 40.2 km$^2$. The actual contour areas for summer 2017 will be determined after completion of the summer assessment period (mid June to mid September 2017).

## 4.2 As Forecast for E.S.

In the E.S. it was forecast that about 18mppa throughput would occur by 2028. That is 11 years after the introduction of re-engined Airbus A320 family, and 9 years after the introduction of re-engined Boeing 737 aircraft by Luton airlines. Noise contours were produced for conditions in 2028 in the E.S. for the Airport serving 17.8mppa, on the assumption of no fleet modernization and partial fleet modernization.

In Section 2.2 Table 4 notes the consequential noise contour areas for daytime and night-time for 2028. These contours were produced on the basis of conservative estimates of the degree of benefit of the re-engineering process; in essence a 3 dB reduction on take-off and landing.

Appendix 4 gives the future individual aircraft characteristics for the main aircraft types expected to operate at Luton Airport. These include the Airbus A320neo, which is the re-engined Airbus A320, and the Airbus A321neo soon to be operated by Wizz Air.

Table 8 shows the outcome of formal testing on the re-engined Airbus A320neo aircraft, and gives a comparison with two current Airbus A320s that can operate at Luton. For this re-engined aircraft type the improvement over existing aircraft is greater than the conservative estimate mentioned above used for the E.S. (computed in 2012). This may indicate that if the 2028 activity (18mppa) forecast in the E.S. occurs the contours will have an area less than previously predicted. However this indication cannot be confidently assumed whilst the performance of other re-engined aircraft types is unknown, furthermore the interpolation from noise certification test results to performance at Luton is complex. The first few noise results for EasyJet A320neo operations at Luton indicate reduced departure noise as implied by the noise certification test results. The rate of introduction of the re-engined aircraft at Luton is also not known.

Table 9 shows in a similar manner, the recent noise certification results for the Airbus A321neo.

The contour areas given in the E.S. are still considered a reasonable assessment. That reasonable assessment advised that if the Airport accommodates 18mppa and no significant usage occurs of re-engined aircraft (as will be the case for several years), the contour area will be in excess of the daytime noise contour limit (19.4 $km^2$), at around 23.7 $km^2$, and the night-time limit (37.2 $km^2$), at around 48.0 $km^2$. Further noise contouring has been made recently to assess in more detail the effects of aircraft mix, future aircraft noise characteristics, and the % of the aircraft fleet modernized.

**Fleet Modernization**

Many different aircraft types operate at Luton Airport. The five most common are shown in Table 5, and consist of Airbus A319, A320, A321 types and Boeing 737 400 and 800 series aircraft. They can be described as aircraft of the Airbus A320 family and Boeing 737 family.

The manufacturers of both families have developed re-engined versions and first examples are now flying. Unlike the Boeing re-engined aircraft, Airbus last year delivered into commercial service 68 re-engined aircraft; and made 48 further deliveries in the first five months of 2017 worldwide. The Boeing 737 MAX entered service in May 2017 with Malindo Air in Malaysia.

For two of the Airbus family, the in-service A320neo and the A321neo formal noise testing has been completed. For the A320neo this is with either the Pratt + Whitney geared turbo fan (PW 1127G-JM) or the alternative CFM International Leap turbo fan (LEAP-IA26). Table 8 gives the noise certification levels obtained during this recent testing, and compares the results with the noise certification levels for two current A320 aircraft operated by easyJet. Table 9 gives results for the larger Airbus aircraft, A321 neo, and compares the results with the noise certification levels for two current A321 aircraft operated by Thomas Cook.

**Table 8 Airbus A320 Certification Data Comparison**

| Aircraft | Take-off Mass (kg) | Noise Certification Levels (EPNL dB) | | |
|---|---|---|---|---|
| | | Lateral | Flyover | Approach |
| G-EZOH[1] | 77,000 | 92.9 | 84.8 | 95.2 |
| A320neo(PW)[2] | 77,000 | 87.2 | 80.7 | 92.0 |
| | Difference | -5.7 | -4.1 | -3.2 |
| A320neo(CFM)[3] | 77,000 | 85.8 | 80.9 | 92.4 |
| | Difference | -7.1 | -3.9 | -2.8 |
| G-EZTH[1] | 73,500 | 93.6 | 83.7 | 95.5 |
| A320neo(PW)[2] | 73,500 | 87.3 | 79.4 | 92.0 |
| | Difference | -6.3 | -4.3 | -3.5 |
| A320neo(CFM)[3] | 73,500 | 85.9 | 79.8 | 92.4 |
| | Difference | -7.7 | -3.9 | -3.1 |

(1) Existing easyJet aircraft, to be replaced by A320neo powered by new CFM Leap 1A engine.
(2) Airbus A320neo with Pratt &Whitney geared turbofan (PW1127G-JM).
(3) Airbus A320neo with CFM International Leap turbofan (LEAP-1A26).

| Table 9 Airbus A321 Certification Data Comparison | | | | |
|---|---|---|---|---|
| Aircraft | Take-off Mass (kg) | Noise Certification Levels (EPNL dB) | | |
| | | Lateral | Flyover | Approach |
| G-TCDD[1] | 93,500 | 95.9 | 88.3 | 96.5 |
| A321neo (PW)[2] | 93,500 | 88.8 | 85.2 | 94.4 |
| | Difference | -7.1 | -3.1 | -2.1 |
| G-TCDN[1] | 93,500 | 95.9 | 88.3 | 96.5 |
| A321neo (PW)[2] | 93,500 | 88.8 | 85.2 | 94.4 |
| | Difference | -7.1 | -3.1 | -2.1 |

[1] Existing Tomas Cook aircraft acquired in 2014-2016.

[2] Airbus A321neo with Pratt &Whitney geared turbofan (PW1133G-JM).

Compared to the existing easyJet A320 aircraft the CFM powered A320neo, which will form some of the future easyJet fleet, is 7 to 8 dB quieter on initial departure (lateral), 4 dB quieter near the Luton fixed monitors (flyover), and 3 dB quieter on landing (approach). It is also quieter than the existing lighter A319 aircraft. The A321 neo with the Pratt & Whitney geared turbo engines is similarly 7dB quieter on initial departure, 3 dB on flyover, but only 2dB quieter on landing.

Formal noise testing has been completed for the Boeing 737 MAX 8 with the CFM International Leap turbo fan (LEAP-IB25/27/28B1). Table 10 gives the noise certification levels obtained during this recent testing, and compares the results with the noise certification levels for current examples.

| Table 10 Boeing 737-800 Certification Data Comparison | | | | |
|---|---|---|---|---|
| Aircraft | Take-off Mass (kg) | Noise Certification Levels (EPNL dB) | | |
| | | Lateral | Flyover | Approach |
| Current Example | 79,000 | 94.5 | 85.9 | 96.4 |
| Current Example | 79,000 | 94.8 | 85.8 | 96.3 |
| MAX 8 - IB25 | 79,106 | 87.5 | 83.2 | 94.2 |
| MAX 8 - IB27 | 79,106 | 88.0 | 82.4 | 94.2 |
| MAX 8 - IB28B1 | 79,106 | 88.6 | 81.5 | 94.2 |
| | Difference | -7.3 to -5.9 | -2.7 to -4.4 | -2.2 to -2.1 |

These results are similar to what has been assumed to assess the contribution to future contours of landing noise, but suggest a greater reduction for departing aircraft. This implies future contours will be smaller than initially forecast when a large proportion of departing aircraft use such re-engined aircraft. Boeing started in May 2017 deliveries of the re-engined 737 aircraft.

With respect to Luton Airport, several of the main operators have placed large orders for re-engined Airbus and Boeing aircraft. For instance easyJet has ordered to receive 100 new re-engined A320neo aircraft in the period 2017-2022. Wizz Air is to receive A321neo aircraft in the period 2019-2024. New Boeing 737 MAX aircraft have been ordered by Monarch, TUI, Ryanair and Sun Express. The large order from Ryanair is to be delivered in the period 2019-2024.

It has to be noted that new, not re-engined, aircraft are also being acquired now and ordered for delivery soon. For instance Thomas Cook has recently received 25 Airbus A321 aircraft. With regard to the degree of fleet modernization, as represented by the usage of the re-engined types, the current non-re-engined types must be expected to operate for many years. These aircraft meet all international noise standards, and are much quieter than the old marginally compliant Chapter III aircraft that sometimes cause community complaints. The fleet development plans of several operators are not publically available.

## 4.3 Further Noise Contouring

New noise contouring has been carried out for the Airport operating at 18mppa in the next few years, and again for 11 years hence, 2028. The contouring seeks to illustrate the effect of aircraft mix, future aircraft noise characteristics, the effect of the degree of fleet modernisation. Before presenting the results of the contouring the factors are briefly discussed; most of the contour inputs were, as used in the original (2012) 18mppa assessments.

Aircraft Mix

The dominance of single aisle twin turbo-jet transport aircraft (the Airbus A320 and Boeing 737 families) is expected to continue. The only trend with respect to these types is the general move from the lower passenger carrying variants to those with higher passenger capacity.

In the analysis made in 2012, it was forecast that the aircraft within the Airbus and Boeing families would be made up of:

| | | Annual Movements* | | | |
|---|---|---|---|---|---|
| | Passengers | 2012 | 2015 | 2028 | 2028[(1)] |
| Airbus A319 | 156 | 38% | 34% | 29% | ----- |
| Airbus A320 | 174-186 | 35% | 43% | 36% | 36% |
| Airbus A321 | 185-220 | 3% | 3.5% | 7% | 22% |
| Boeing 737-800 | 160-189 | 14% | 13% | 23% | 36% |

(NB *% of passenger movements)

[(1)] Alternative Mix. [2017]

It is expected now that although the A320 will remain the most common type, there will be a growth in the A321 aircraft and a consequential large reduction in A319 aircraft numbers. A large growth in Boeing 737-800 aircraft activity is also now expected. Therefore sensitivity tests have been made with an alternative aircraft mix, details given in Appendix 3.

Future noise characteristics.

As mentioned earlier past contouring whilst no certification test data was available, assumed an elementary 3dB reduction in both departure and landing noise. Although Aircraft operational noise data is still not available, the formal noise certification tests have now been made and reported on both engine variants of the Airbus A320 and variants of the Airbus A321. See tables 8 & 9. The results compared with results obtained during the noise certification for current versions was discussed earlier, and noted that the re-engined versions record a 7dB improvement on initial departure climb, 3-4 dB on flyover [6.5 kms from start of roll] and 2-3 dB on approach. Sensitivity tests have been made here on the basis of 5dB improvement for departure noise (effectively, average improvement of the two noise certification results used for departures), and 2-3 dB improvement for landings. These are compared to contours with 3dB improvements made for both landings and departures as used previously.

Fleet Modernisation.

The contouring discussed in the report has considered for the next few years either no modernisation or “25%”. The 25% applies to the Airbus A320 and A321 aircraft, and the Boeing 737-800; that is not to the Airbus A319 where no orders have been placed for the NEO version by any of the Luton operators, and not for the other passenger and cargo aircraft. Table 11 summarizes the noise contours now presented.

| Table 11 Noise Contours Presented | | | |
|---|---|---|---|
| **Scenario** | **Aircraft Mix** | **Noise Characteristics** | **% Modernisation** |
| Worst Intermediate Year (18mppa) | | | |
| (A) | E.S. Mix | As now | nil |
| (B) | Alternative Mix | As now | nil |
| (C) | E.S Mix | -3 dB Arr /-3 dB Dep | 25% |
| (D) | Alternative Mix | -3 dB Arr /-3 dB Dep | 25% |
| (E) | E.S Mix | -3 dB Arr /-5 dB Dep | 25% |
| 2028 (18mppa) | | | |
| (F) | E.S Mix | -3 dB Arr /-3 dB Dep | 100% |
| (G) | New 2028 Mix | -3 dB Arr /-3 dB Dep | 100% |
| (H) | New 2028 Mix | -3 dB Arr /-5 dB Dep | 100% |

Appendix 3 contains more details of the contour inputs, and the detailed contouring results. Table 12 summarises the Day time contour areas, and the Night time contour areas. Tables 13 and 14 illustrate the noise in specific local areas and how dwelling/population exposure changes.

| Table 12 Noise Contour Areas ($km^2$) | | |
|---|---|---|
| **Scenario** | **Daytime: 57 dB $L_{Aeq,16h}$** | **Night time: 48 dB $L_{Aeq,8h}$** |
| Worst Intermediate Year: (18mppa) | | |
| Without Fleet Modernization | | |
| (A) E.S. Mix | 23.4 | 46.5 |
| (B) Alternative Mix | 24.0 | 51.7 |
| With 25% Fleet Modernization (-3/-3) | | |
| (C) E.S Mix | 21.3 | 42.9 |
| (D) Alternative Mix | 21.8 | 47.7 |
| With 25% Fleet Modernization (-3/-5) | | |
| (E) E.S Mix | 20.8 | 42.3 |
| 2028 (18mppa) | | |
| With 100% Fleet Modernization (-3/-3) | | |
| (F) E.S Mix | 14.3 | 30.8 |
| (G) New 2028 Mix | 15.4 | 36.4 |
| With 100% Fleet Modernization (-3/-5) | | |
| (H) New 2028 Mix | 12.6 | 30.8 |
| Planning Condition 12 Initial | 19.4 | 37.2 |
| Limits ($km^2$) 2028 | 15.2 | 31.6 |

The sensitivity tests summarized in Table 12 indicate;

For the Worst Intermediate Year (assuming 18 mppa)

- Daytime contours ranging in area (57 dB $L_{Aeq,16h}$) from 20.8 – 24.0 km squared, all in excess of the area limit.
- The worst case, (B), occurs when the 18mppa is served by existing aircraft types (no re-engined aircraft) and greater relative activity by the Airbus A321 as opposed to the smaller A319 aircraft. The forecast daytime contour exceeds the area limit by 24%, at night the excess is 39%.
- The use of some re-engined types (25%) reduces the noise contour areas by about 10%.
- Night time contours ranging in area (48 dB $L_{Aeq,8h}$) from 42.3 – 51.7 km squared, all in excess of the interim area limit.
- The best intermediate case, (E), is with the original E.S. mix (i.e. continued major use of the smaller A319) and use of 25% re-engined types. In that case the excess over the Condition 12 interim limit is for day time 7%, and for night time 14%.

For 2028 (18 mppa)

- Daytime contours ranging in area (57 dB $L_{Aeq,16h}$) from 12.6 to 15.4 km², less than or marginally in excess of the Condition 12 (2028) limit. The excess is not forecast if the original aircraft mix is assumed, or the aircraft noise characteristics are better than assumed.
- Night-time contours ranging in areas (48 dB $L_{Aeq,8h}$) from 30.8 to 36.4 km², less than the Condition 12 (2028) limit, unless the alternative mix and the worst aircraft noise characteristics are adopted.

## 5.0 CONFLICT WITH PLANNING CONDITION 12

### 5.1 Short-Term

In the short-term there will clearly be a conflict with one of the requirements in Condition 12. This arises as the contour area limits, until the quieter re-engined aircraft operate in large numbers, will be exceeded if the Airport is required to accommodate greater traffic than in 2016 and up to 18mppa. The significance of this forecast exceedance is considered here, in terms of what increases would occur for local residents. Table 13 assesses the noise levels at typical locations in 2016, the Worst Intermediate Year, (W.I.Y.) and 2028 as given in the E.S. with partial fleet modernisation. For the WIY the worst (B) and best case (E) forecast results are given. Table 14 summarises the number of dwellings and population for the same scenarios.

| Table 13 Current and Future Noise Levels[1] for Local Residents (dB $L_{Aeq,T}$) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Location** | **2016** | | **W.I.Y. Scenario B[2]** | | **W.I.Y. Scenario E[2]** | | **2028 E.S.** | | **Diff[3]** | |
| | **Day** | **Night** | **Day** | **Night** | **Day** | **Night** | **Day** | **Night** | **Day** | **Night** |
| Old Knebworth | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Caddington | <54 | 49 | 55 | 51 | 54 | 50 | 54 | 49 | +1 | +2 |
| Park Town, Luton | 60 | 54 | 61 | 57 | 59 | 54 | 61 | 56 | - | +1 |
| Whitwell | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Breachwood Green | 54 | 49 | 55 | 51 | 55 | 50 | 54 | 49 | +1 | +2 |
| St Pauls Walden | <54 | 49 | 54 | 50 | 54 | 49 | <54 | 49 | +1(?) | +1 |
| Peter's Green | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Kinsbourne Green | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Farley Hill School Luton | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Slip End | 60 | 54 | 62 | 58 | 60 | 56 | 60 | 55 | +2 | +3 |
| Winch Hill Farm | 60 | 54 | 60 | 56 | 59 | 54 | 59 | 54 | +1 | +2 |
| Harpenden Children's Home | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Walkern | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Stevenage (Eastern Edge) | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Stevenage Station | <54 | 49 | 54 | 50 | <54 | 49 | <54 | 48 | +1(?) | +2 |
| Rush Green | 55 | 51 | 56 | 52 | 55 | 51 | 55 | 50 | +1 | +2 |
| Wondon End, Luton | <54 | <48 | 54 | 49 | <54 | 48 | <54 | 48 | +1(?) | +1 |
| Kensworth | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Hudnall Corner | <54 | <48 | <54 | <48 | <54 | <48 | <54 | <48 | - | - |
| Flamstead | <54 | <48 | <54 | 49 | <54 | <48 | <54 | <48 | - | +1(?) |
| Markyate | <54 | <48 | <54 | 48 | <54 | <48 | <54 | <48 | - | +1(?) |

(1) Rounded to the nearest whole number.

(2) Worst Intermediate Year – Scenario B Worst Case, Scenario E Best Case.

(3) Difference between Worst Intermediate Year Scenario B and 2028 in E.S. with partial fleet modernisation.

The table also includes the difference in the noise levels between the Worst Intermediate Year and that forecast in the E.S. for 2028, where partial modernisation was assumed. For many of the locations the levels are outside the range of the standard contours, and so no differences are given. For the more exposed locations the level is generally higher, by 1-2 dB during the daytime and by 2-3 dB during the night-time, for the Worst Intermediate Year (Worst Case).

**Table 14 Dwelling and Population Exposure: NOW AND FUTURE**

| Noise Band | Number of Dwellings[1] | | | | Population[1] | | | |
|---|---|---|---|---|---|---|---|---|
| | 2016 | W.I.Y. [2] Scen B | W.I.Y. [2] Scen E | 2028 E.S. [3] | 2016 | W.I.Y. [2] Scen B | W.I.Y. [2] Scen E | 2028 E.S. [3] |
| **Daytime (dB $L_{Aeq,16h}$)** | | | | | | | | |
| 57 - 60 | 1,850 | 1,800 | 1,750 | 2,050 | 4,900 | 4,100 | 4,250 | 4,400 |
| 60 - 63 | 950 | 1,300 | 750 | 950 | 2,600 | 3,400 | 1,950 | 2,700 |
| 63 - 66 | 650 | 690 | 440 | 500 | 1,800 | 1,820 | 1,120 | 1,500 |
| 66 - 69 | <50 | <10 | 10 | <50 | <100 | 20 | 30 | <100 |
| >69 | 0 | <10 | 0 | <50 | 0 | 10 | 0 | <100 |
| **Night-time (dB $L_{Aeq,8h}$)** | | | | | | | | |
| 48 - 51 | 2,700 | 6,700 | 3,500 | 3,100 | 7,200 | 15,550 | 8,100 | 7,400 |
| 51 - 54 | 1,700 | 2,600 | 1,900 | 2,450 | 4,400 | 6,950 | 4,350 | 5,400 |
| 54 - 57 | 1,000 | 1,650 | 1,300 | 1,500 | 2,900 | 3,950 | 3,300 | 3,600 |
| 57 - 60 | 450 | 1,000 | 680 | 600 | 1,300 | 2,600 | 1,860 | 1,600 |
| 60 - 63 | <50 | 440 | 20 | 200 | <100 | 1,170 | 30 | 600 |
| 63 - 66 | 0 | 10 | <10 | <50 | 0 | 30 | 10 | <100 |
| >66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

(1) Rounded numbers given based on postcode data for 2015 from CACI Ltd.

(2) Worst Intermediate Year – Scenario B Worst Case, Scenario E Best Case.

(3) Taken from E.S. and based on postcode data for 2011 from CACI Ltd. Use of different population data for 2011 and 2015 causes any comparison to be approximate.

Overall the population contained within the daytime contours for the Worst Intermediate Year (Worst Case) is larger, at approximately 9,350, than the approximately 8,800 forecast in the E.S. for 2028, where partial modernisation was assumed. This would be expected from the larger overall size of the contours for the Worst Intermediate Year. For the best case W.I.Y., the daytime population is forecast as 7,350, less than now.

When considering those exposed to the highest noise levels, for example for the noise exposure band 63 to 66 dB, there is a similar population about 1,800 for the Worst Intermediate Year (Worst Case) as now, more than the 1,500 for 2028 given in the E.S.

For the populations within the night-time contours comparison of the Worst Intermediate Year (Worst Case) and 2028 given in the E.S. indicates the population contained within the night-time contours for the Worst Intermediate Year is larger.

The conflict with Condition 12 initial noise contour area limits relates to the need to accommodate 18mppa several years before it can be assumed that the benefit of the new re-engined Airbus and Boeing is evident. As shown in Table 12 with no fleet modernization a problem exceedance of Condition 12 is expected. In practice, as for instance easyJet will take delivery of some new re-engined Airbus A320 aircraft this year, prior to the Airport serving 18mppa (forecast for 2020), some fleet modernization can be foreseen.

Consideration of the effect of various fleet modernization situations on the contour areas, all assuming traffic compatible with 18mppa, indicates contour area reduction. However the immediate benefit does not appear sufficient to overcome the excess.

## 5.2 Long-Term

In the long-term, 2028 onwards, as the airlines acquire and operate at Luton the new quieter aircraft, the Airport may be able to accommodate 18mppa whilst meeting the requirements of Planning Condition 12 unaltered. The latest assessment of noise in 2028, related to 18mppa, indicates slightly larger contours than envisaged when the E.S was produced in 2012, when the alternative mix is used and initial assumptions on noise characteristics made. Table 12 records the predicted noise impacted areas, daytime, 57 dB $L_{Aeq,16h}$ and above, and night-time, 48 dB $L_{Aeq,8h}$ and above, for 2028 with the contour areas specified in Planning Condition 12.

# 6.0 CONFLICT RESOLUTION

To address the forecast conflict it is necessary to modify Planning Condition 12, and whilst operating within the capacity restraint arising from Condition 10 (alias 18mppa) to seek and implement further mitigation to mitigate the temporary extra airborne aircraft noise.

## 6.1 Transitional Arrangement

The arrangement sought is to allow the airport to operate within a new noise contour area for the ‘worst case’ intermediate year. The areas of those for contours for daytime and night-time are given in Table 12 for the Alternative Mix (without Fleet Modernisation).

Consideration has been given to future years in light of the new noise certification information on the main aircraft types, the Airbus A320 family and the Boeing 737 family. Whilst the noise contour area will be greater in the short-term, the Airport will commit to reducing noise levels associated with 18 mppa longer-term. As such, the Airport will reduce the area of the noise contours to 15.2 sq km for daytime noise and 31.6 sq km for night-time noise by 2025 instead of 2028 as originally approved. This now appears practicable due to several matters, such as the NATS commitment to have in place a new airspace arrangement by 2024, so allowing Luton aircraft to fly higher.

As well as these changes, it is required that the Airport will prepare a Contour Reduction Scheme that will define the methods to be used by LLAOL to monitor and review the area of the contours against actual noise levels annually, and to reduce the area of the contours accordingly. Such a process is already in place, and will be developed to demonstrate the adequacy of the process.

With regard to noise controls it should be noted the existing Noise Control Scheme will remain in place. As a result, the airport will remain constrained by a range of noise controls, such as a quota count and movement limits on activity at night and a limit on early morning movements.

A revised condition 12 on this basis is contained in Appendix 5. Also the airport will put in place an extra mitigation package to compensate for additional noise in the short-term.

The extra mitigation package has been consolidated to a smaller number of measures that will have a quantifiable impact on the noise contours and beneficial impact on surrounding communities.

The three mitigation measures are listed below:

a. Introduce a published 10% differential for landing fees of re-engined aircraft (e.g. Airbus Neo's) from 1st April 2018 (the next tariff publication date).

b. Introduce a published 10% differential for landing fees of Chapter 14 aircraft from 1st April 2018 (the next tariff publication date).

c. Increase noise insulation fund by 15% per annum from 1st January 2018 for a period of 5 years.

It is intended that an effect of these measures will be to reduce the forecast exceedance of the Airports' noise contour limits. To ensure stakeholders can monitor that the operators are seeking to minimise noise, extra noise monitoring and regular reporting will be put in place.

## 7.0 CONCLUSIONS

Planning Condition 12 includes stringent reductions in the allowable areas of the Airport's noise contours for daytime and night-time noise, viz.

| **Daytime Contour Area** | **Limits** |
|---|---|
| Past 1998 – 2014 | 31.52 |
| Initial 2014 – 2028 | 19.40 |
| Future 2028 - | 15.20 |
| **Night-time Contour Area** | **Limits** |
| Past 1998 – 2014 | 85.04 |
| Initial 2014 – 2028 | 37.2 |
| Future 2028 - | 31.6 |

The projections of future contour areas at the time (2012) of the production of the Environmental Statement took into account growth in activity at the Airport and the introduction of new quieter aircraft. The actual growth in activity has been unprecedented, with for instance activity in 2016 was 14.6 mppa not 11.5 mppa as forecast in 2012. It is now envisaged that 18mppa could be reached by 2020 not 2028 as forecast in 2012.

This unprecedented growth causes increases in the Airport's noise contours whilst the introduction of quieter aircraft at the Airport has not yet occurred. One of the resident airlines at the Airport will receive this year some of the quieter re-engined Airbus A320neo aircraft.

Several of the airlines at the Airport have placed large orders for the new quieter re-engined aircraft, with deliveries sought in the period 2017 to 2024. Other airlines have not yet indicated acquisition of new aircraft, and are presumed to operate their existing aircraft which fully meet international noise standards for many years. Some of the existing aircraft have only recently been acquired i.e. in 2017.

The issue with this more rapid growth is that whereas the associated noise was previously considered on the expectation of the use by the airlines of the new quieter re-engined single aisle narrow bodied transports when the airport reached 18mppa in 2028, now future noise has to be considered in the worst case of no fleet modernisation or only small numbers of the new quieter aircraft operating at Luton.

The size of the future noise contour areas will be determined by the actual activity at the airport, the noise characteristics of the Luton aircraft fleets, and the detailed way they are operated. On the latter, consideration is constantly given by the Airport, FLOPSC, and LLACC on potential operational improvements. Although there are some measures that appear to have potential, none are currently guaranteed to make a major effect on the noise contour areas.

If we assume that the aircraft operating at Luton in the short term stay dominated by the large fleets of modern single aisle narrow bodied transports which all meet current international noise standards then the future contour areas will increase as activity increases and will soon exceed the limits specified in Condition 12.

The activity at the Airport is approved for 18mppa, a 23% increase on the activity in 2016. Such an increase, assuming no fleet modernisation, results in noise contour areas:-

Daytime: 23.4 – 24.0 $km^2$ (Condition 12 limit 19.4 $km^2$) [E.S. (2012) 23.72 $km^2$]
Night-time: 46.5 – 51.7 $km^2$ (Condition 12 limit 37.2 $km^2$) [E.S. (2012) 48.02 $km^2$]

If we assume that such activity does not arise until the airlines have received their new quieter re-engined narrow bodied single aisle transports (the Airbus A320neo family/the Boeing 737 MAX family), and put them into operation at Luton, the future contour areas will be smaller, i.e.

Daytime: 12.6 – 15.4 $km^2$ (Condition 12 limit 19.4 $km^2$ / 15.2 $km^{2(1)}$)
Night-time: 30.8 – 36.4 $km^2$ (Condition 12 limit 37.2 $km^2$ / 31.6 $km^{2(1)}$)
(1) Limit in 2028.

If the growth rate occurring in 2016 also occurs in 2017, then an excess over the Condition 12 contour limits is forecast. This is because the new re-engined aircraft are not available, for instance the Boeing 737 MAX 8 aircraft will not enter service anywhere before 2017, and the variant selected by one of Luton's main operators will not be available anywhere until 2019.

If the excess in contour area did arise the noise impacted areas will be more extensive. Consideration of local residential area noise exposure indicates differences between what was forecast in the E.S. and what might occur with 18mppa earlier than 2028. For the more exposed locations the level is generally higher, by 1-2 dB during the daytime and by 2-3 dB during the night-time, for the Worst Intermediate Year (Worst Case).

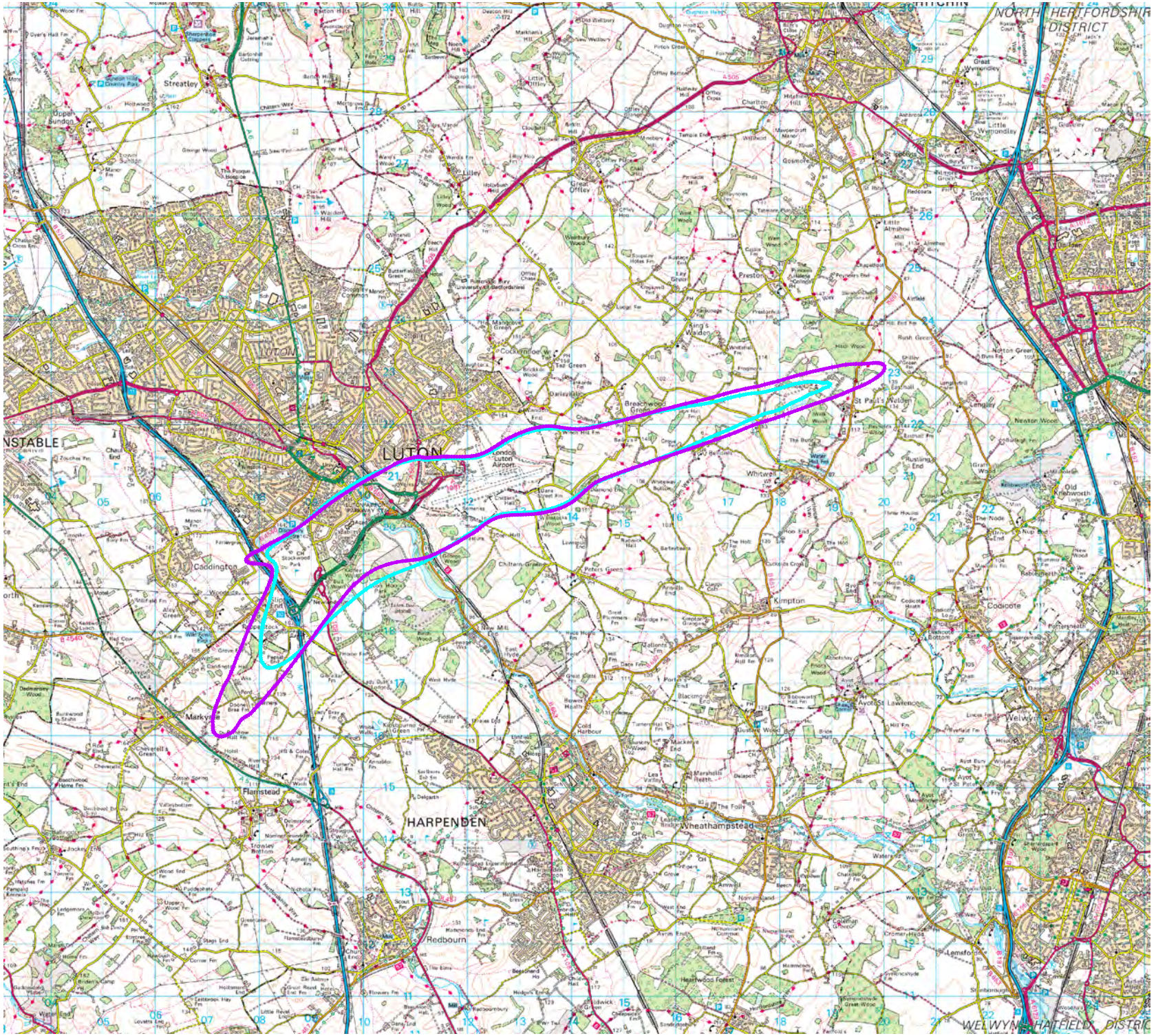
Consideration has been, is, and will be given to various noise abatement measures under development, the Contour Reduction Scheme. Only the use of the new quieter aircraft offers clearly the required reductions in noise contour areas. Therefore the Airport will incentivise operators to use the re-engined quieter aircraft, and completely new chapter 14 compliant aircraft.

To address this forecast problem, it is proposed that transitional arrangements delineated in section 6.1, be put in place to address any additional noise impact arising from accommodating the services sought whilst the major use of the quieter aircraft is developing and maintain noise contour area controls more stringent than those under which the Airport operated in the period 1998 to 2014.

**Jeff Charles**
**for Bickerdike Allen Partners LLP**

**David Charles**
**Associate**

**Peter Henson**
**Partner**






LEGEND:

- 2011
- 2015

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London Luton Airport Development
Planning Condition 12

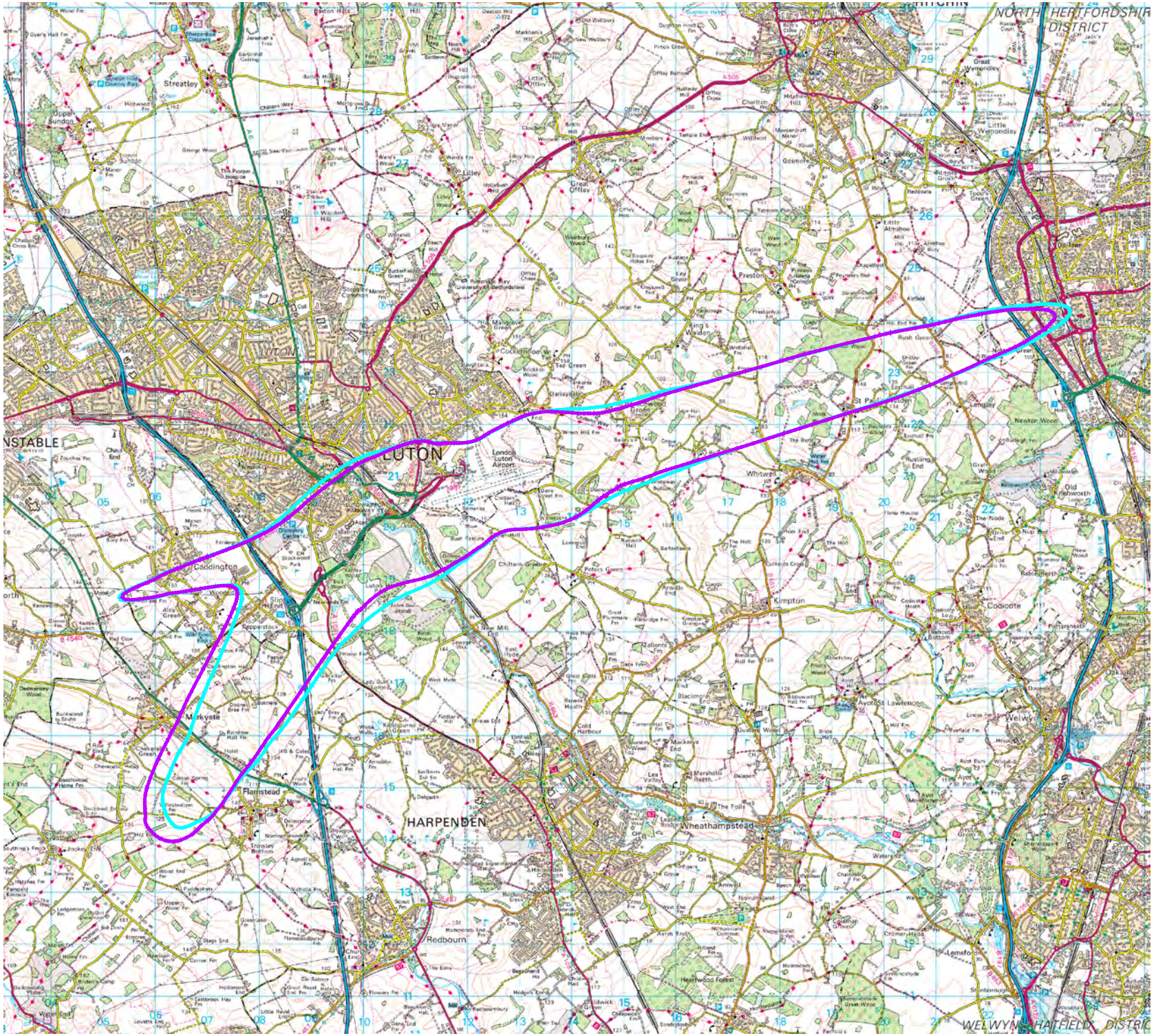
Airborne Aircraft Noise Contours
57 dB $L_{Aeq,16h}$ Summer Daytime for
2011 and 2015

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-01






LEGEND:

- 2011
- 2015

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London Luton Airport Development
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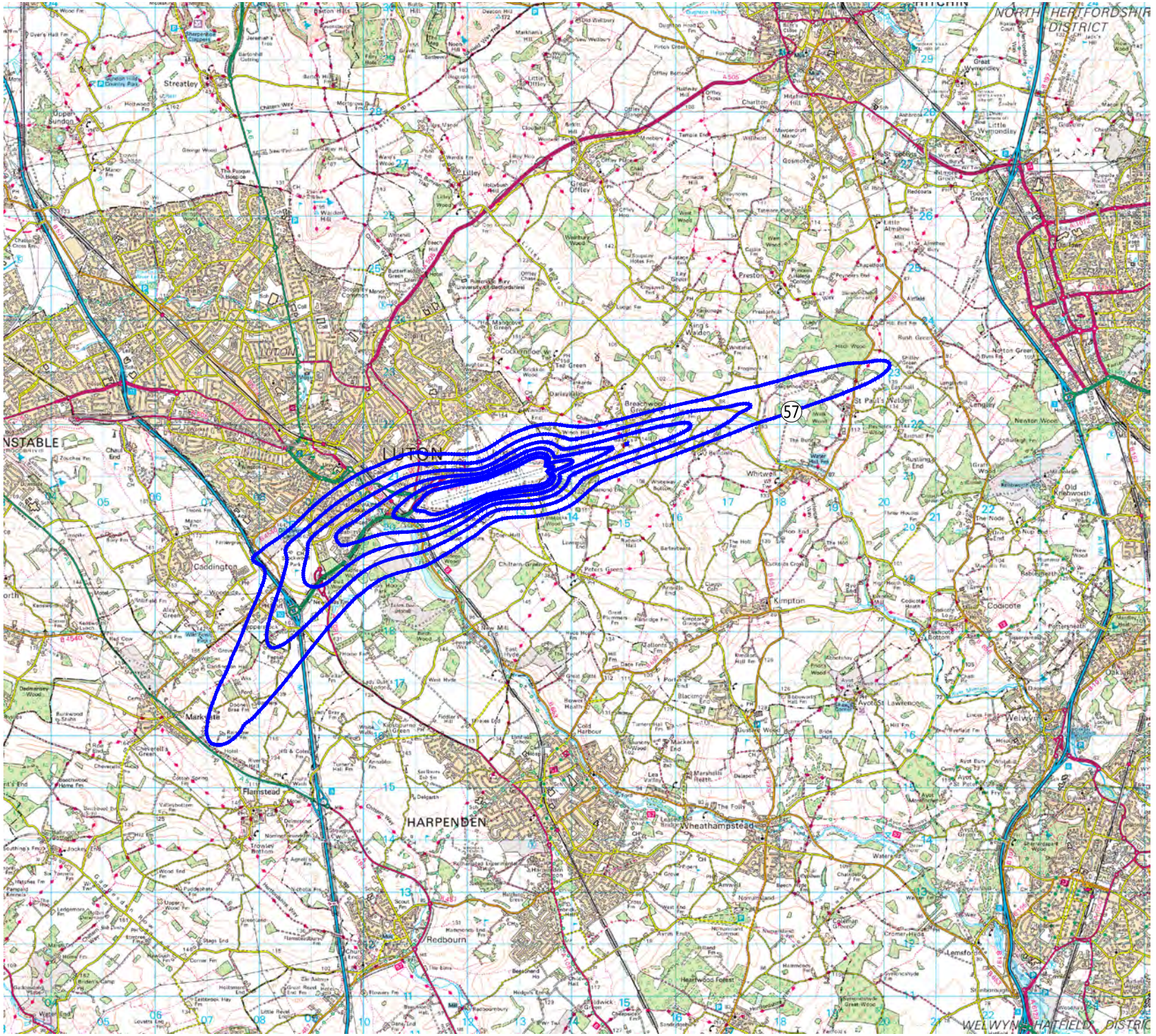
Airborne Aircraft Noise Contours
48 dB $L_{Aeq,8h}$ Summer Night Time for
2011 and 2015

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-02






LEGEND:

Noise Contours,
57 to 72 dB $L_{Aeq,16h}$ in 3 dB Steps

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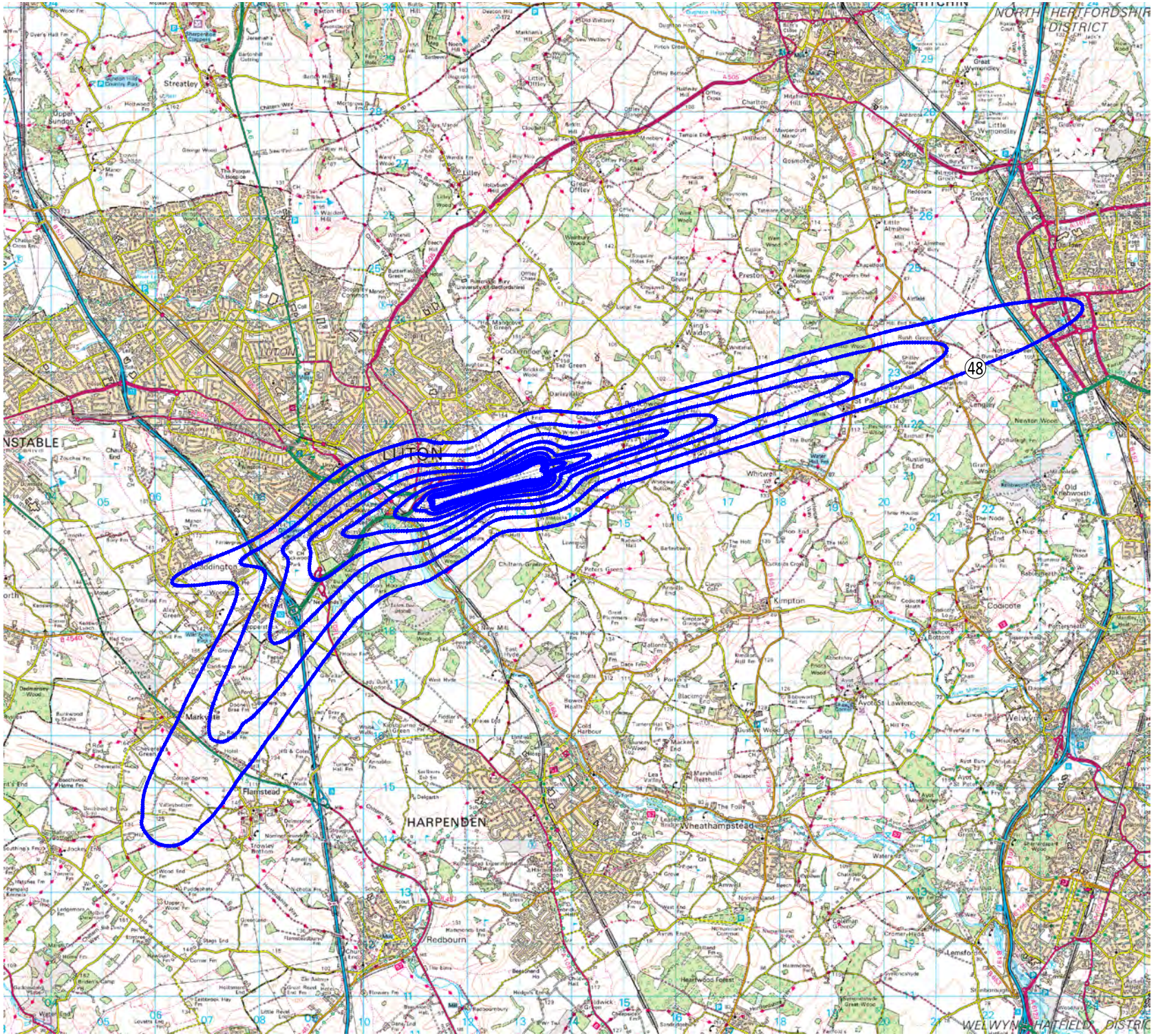
Airborne Aircraft Noise Contours
Summer 2016 Daytime

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-03






LEGEND:

Noise Contours,
48 to 72 dB $L_{Aeq,8h}$ in 3 dB Steps

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London Luton Airport Development
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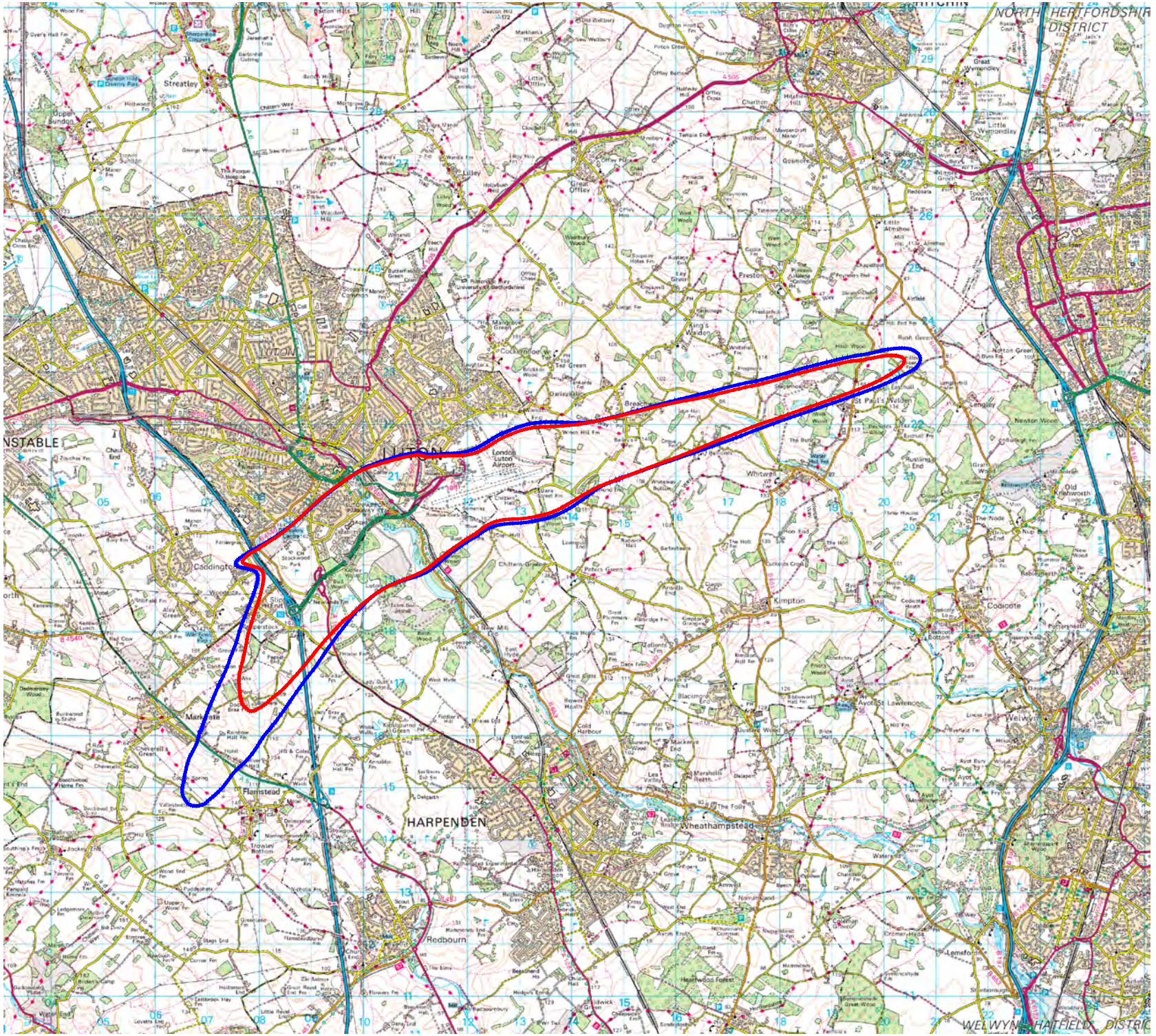
Airborne Aircraft Noise Contours
Summer 2016 Night time

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-04






LEGEND:

- Worst Intermediate Year
- 2028 (ES) - Partial Modernisation

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London Luton Airport Development
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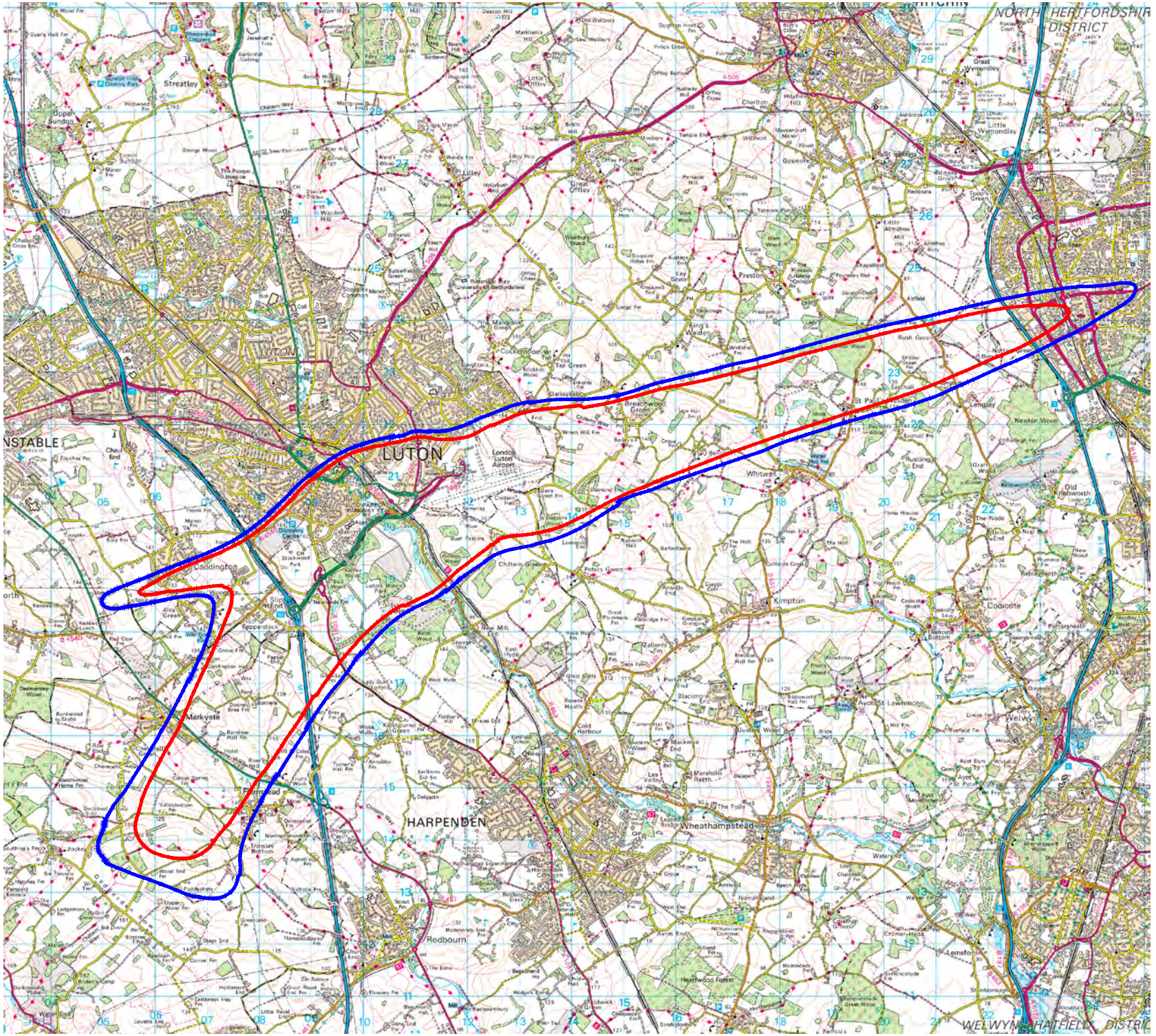
Airborne Aircraft Noise Contours
57 dB $L_{Aeq,16h}$ Summer Daytime
Worst Intermediate Year Vs 2028 (ES)

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-05






LEGEND:

- Worst Intermediate Year
- 2028 (ES) - Partial Modernisation

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London Luton Airport Development
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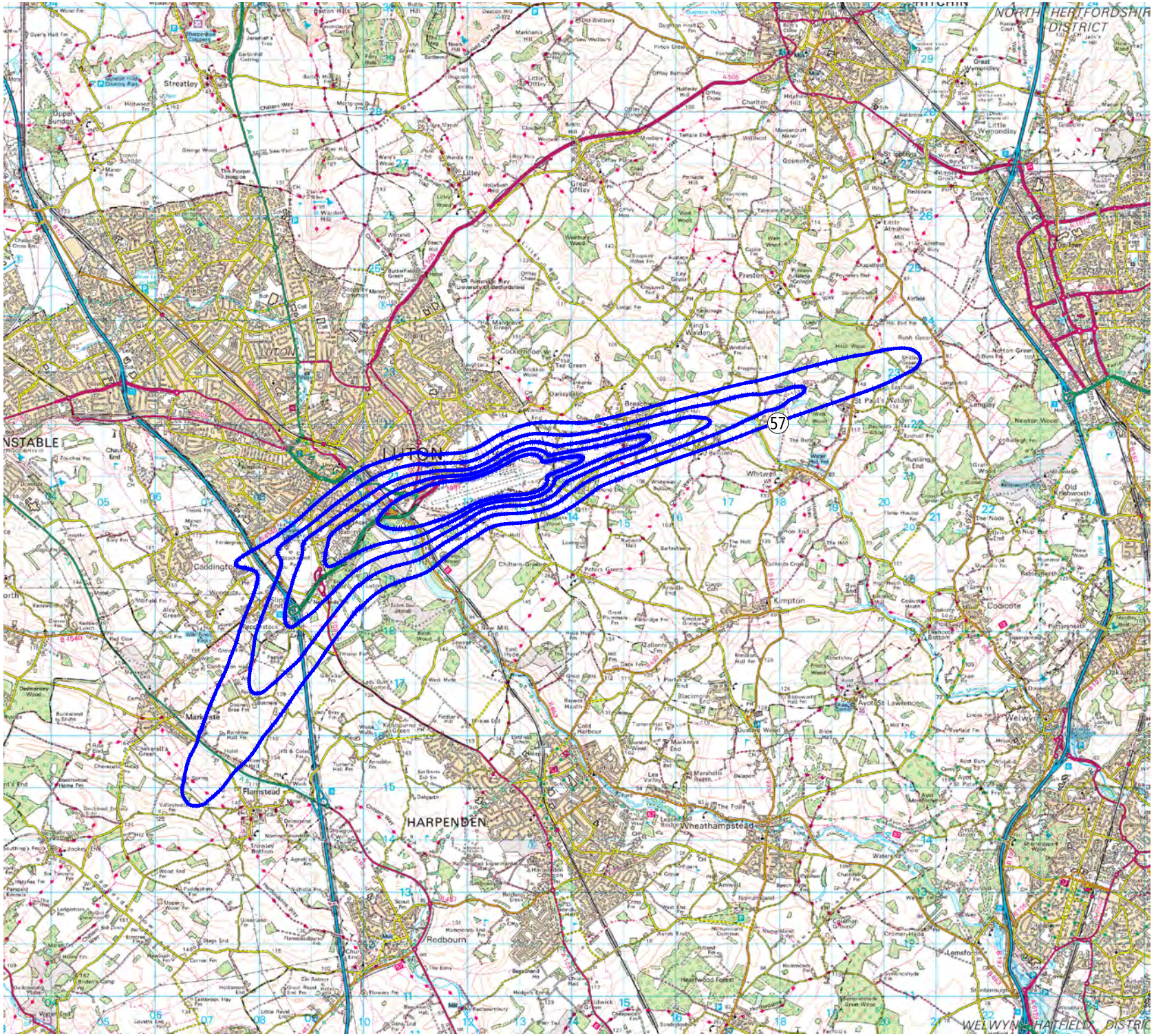
Airborne Aircraft Noise Contours
48 dB $L_{Aeq,8h}$ Summer Night Time
Worst Intermediate Year Vs 2028 (ES)

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-06






LEGEND:

Noise Contours,
57 to 69 dB $L_{Aeq,16h}$ in 3 dB Steps

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

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London Luton Airport Development
Planning Condition 12

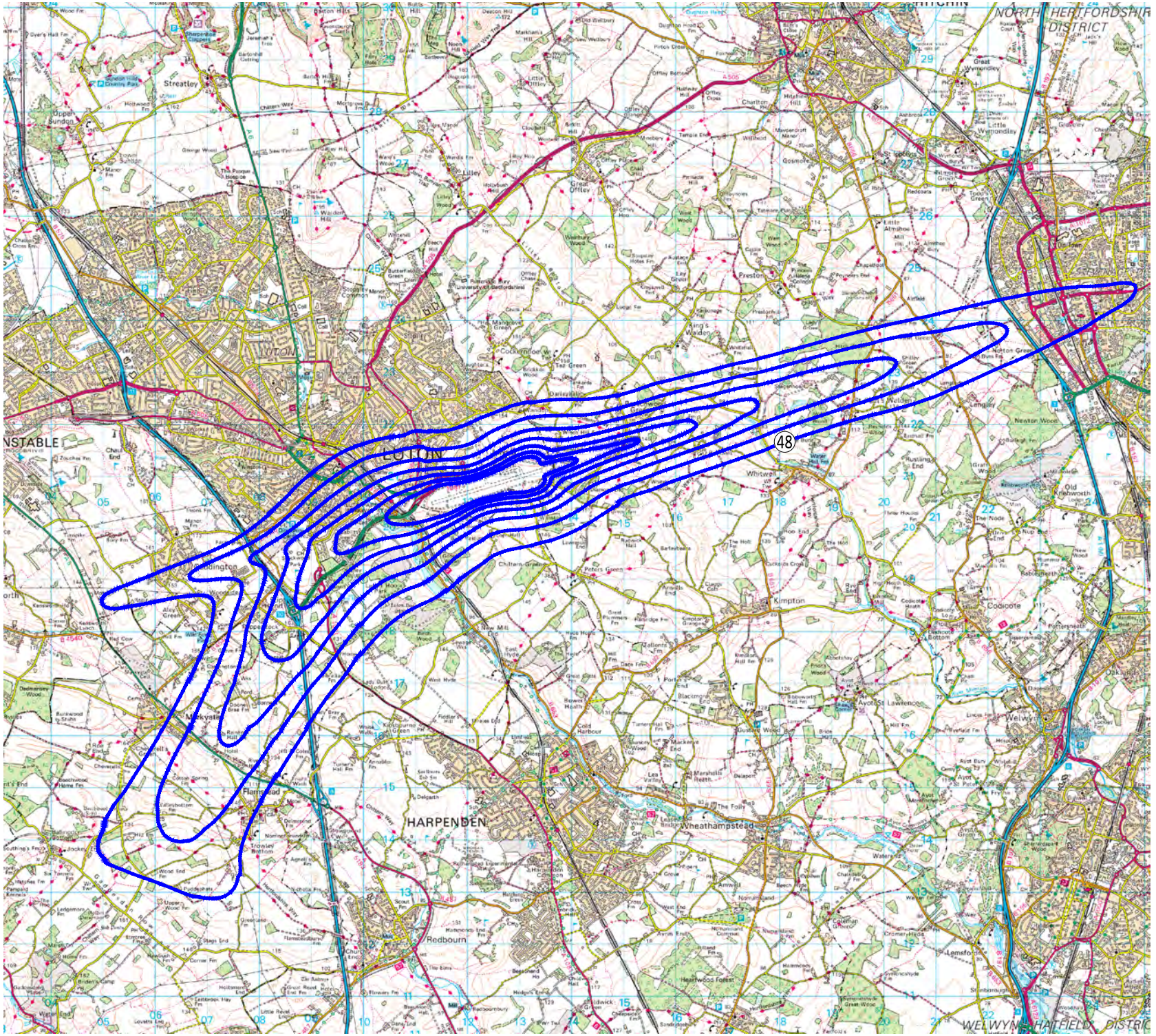
Airborne Aircraft Noise Contours
Worst Intermediate Year
Summer Daytime

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-07






LEGEND:

Noise Contours,
48 to 66 dB $L_{Aeq,8h}$ in 3 dB Steps

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London Luton Airport Development
Planning Condition 12

Airborne Aircraft Noise Contours
Worst Intermediate Year
Summer Night time

DRAWN: DCH CHECKED: DC

DATE: May 2017 SCALE: 1:100000@A4

FIGURE No:

A9501-R06D-08

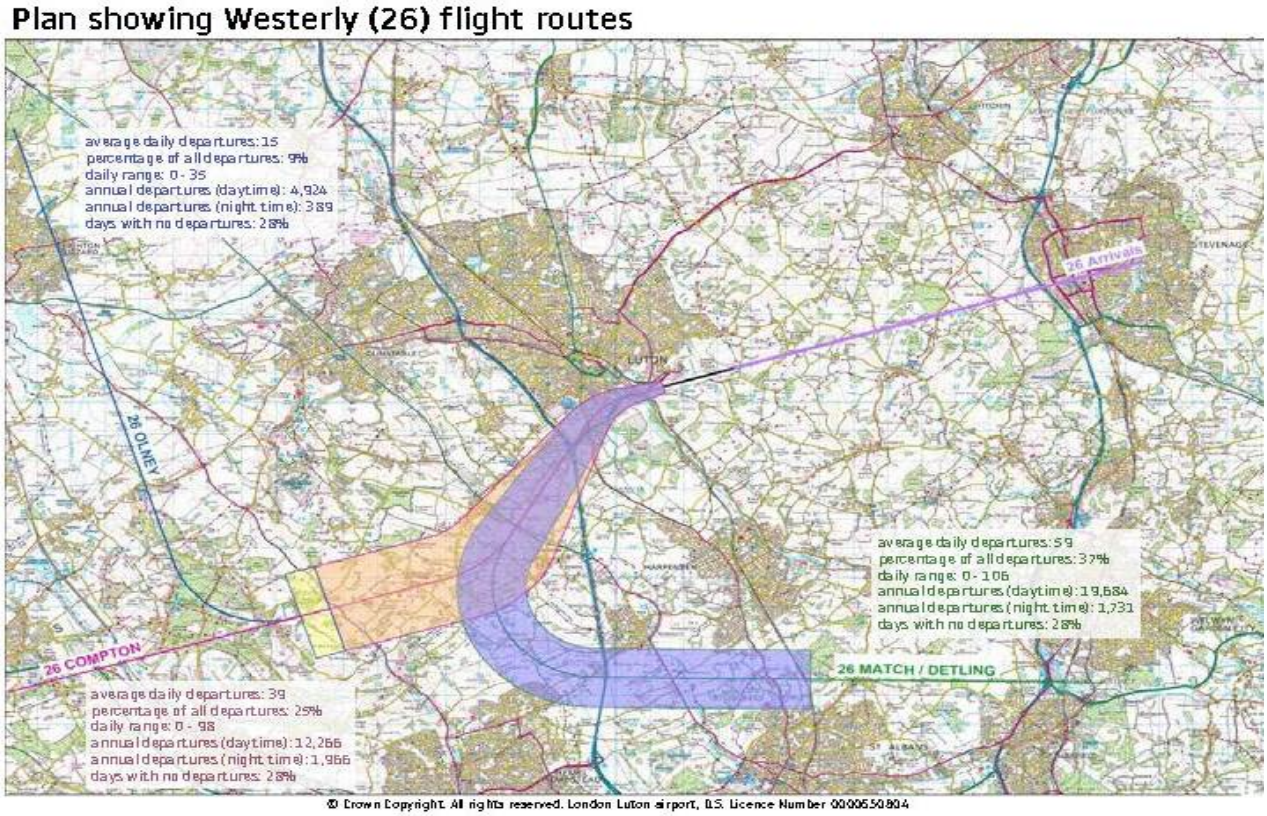



**Figure 9: Westerly Flight Routes**

# APPENDIX 1
# Glossary of Acoustic and Aeronautical Terminology

**The Decibel, dB**

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of $2 \times 10^{-5}$ Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, $L_w$ is expressed in decibels, referenced to $10^{-12}$ watts.

**Frequency, Hz**

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

**A-weighting**

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

**Environmental Noise Descriptors**

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

| Statistical Term | Description |
|---|---|
| $L_{Aeq, T}$ | The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound. |
| $L_{A90}$ | The level exceeded for 90% of the time is normally used to describe background noise. |
| $L_{Amax,T}$ | The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow) |
| SEL | The Sound Exposure Level (SEL) is the sound level in dB(A) of a one second burst of steady noise that contains the same total A-weighted sound energy as the whole aircraft noise event. |
| EPNL | Effective Perceived Noise Level. It's measurement involves analyses of frequency spectra of noise events as well as the duration of sound. |
| EPNdB | The measurement unit for EPNL, that is used for the noise certification of aircraft, and the subsequent QC determination. |

**Aeronautical Terms used in discussion of noise**

| Term | Description |
|---|---|
| NPR | Noise Preferential Routes are pre-defined routes for aircraft leaving an airport. Departing aircraft are asked to stay within defined corridors and wherever possible these are kept away from the most densely populated areas. |
| Ground Track | The vertical projection of an aircraft flight path onto level ground. |
| SOR | Start of Roll: The position of a runway where aircraft commence their take-off runs. |
| ICAO Noise Certification | Noise Certification Measurement Points are for Approach (under a 3 degree descent path 2000m from the runway threshold, Lateral (or Sideline) 450m to the side of the initial climb after lift-off, and Flyover under the departure climb path, 6500m from the start of roll (SOR). |

| | |
|---|---|
| Continuous Descent Approaches (CDA) | For an arriving aircraft to achieve a CDA, the aircraft must achieve a continuous descent with no more than one section of local flight greater than 2.5 Nm in length following descent from an altitude of 5,000ft. |
| Chapter III | This refers to noise standards for aircraft, specification that given in Volume 1, Part II, Chapter 3 of Annex 16, delineated in terms of levels not to be exceeded at the noise certification measurement points. |
| APU | An APU is an auxiliary power unit which is installed on an aircraft to provide power when the aircrafts main engines are not in use, for the purpose of enabling aircraft systems to prepare the aircraft for use whilst the aircraft is on the ground. |
| GPU | A small portable ground power unit, GPU, provides power to allow the aircraft to use its systems when the aircrafts APU is not used. Such units can be effectively silenced. |
| RNAV1 | A more precise navigation system to ensure aircraft fly on a more tightly defined track. |
| Annex 16 | This Annex (Environmental Protection) to the Convention on International Civil Aviation presents Volume 1 Aircraft Noise and Volume 2 Aircraft Engine Emissions. |

| **Committees** | **Description** |
|---|---|
| "Flight Ops" Committee | A committee set up at Luton Airport to allow detailed dialogue between airlines, airline pilots, NATS and LLAOL Operations Staff. |
| LLACC | The London Luton Airport Consultative Committee is set up in-line with Department of Transport guidance for Aerodromes to which Section 35 of the Civil Aviation Act 1982 applies, and has representatives from users, Local Authorities and environmental groups. |
| NTSC | A sub-committee of LLACC, set up to discuss in detail noise and track-keeping issues at Luton Airport. The sub-committee meet four times each year. |

# APPENDIX 2
# Past Noise Contours and Methodology

- Table A2.1: Airport Noise Contour Areas
- Table A2.2: Annual Activity of Main Aircraft Types at Luton Airport (2010-2015)
- Airport Noise Contours: 2010-2015
  (From Annual Monitoring Reports, and latest report for 2015)
- Contouring Methodology: Past Contours

**Table A2.1: Airport Noise Contours Areas: Summer Period**

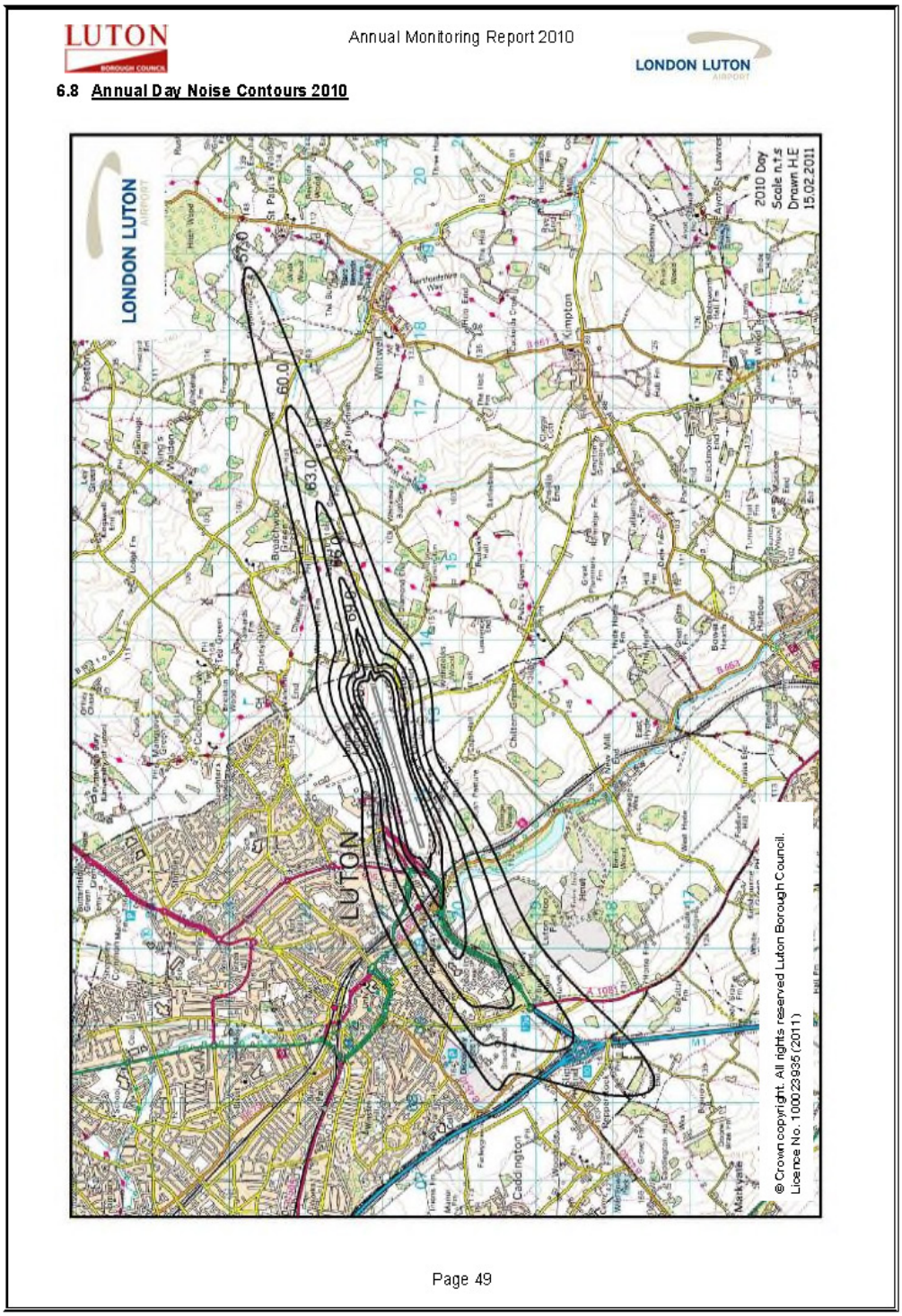
| Year | Area ($km^2$) of Daytime Contour 57 dB $L_{Aeq,16h}$ | Area ($km^2$) of Night-time Contour 48 dB $L_{Aeq,8h}$ |
|---|---|---|
| 2006 | 14.90 | 29.2 |
| 2007 | 15.38 | 33.2 |
| 2008 | 16.6 | 38.5 |
| 2009 | 14.9 | 28.5 |
| 2010 | 13.1 | 32.2 |
| 2011 | 12.8 | 30.1 |
| 2012 | 14.7 | 36.0 |
| 2013 | 13.8 | 30.7 |
| 2014 | 15.8 | 35.2 |
| (2015 forecast) | (16.5) | (36.6) |
| 2015 | 17.2 | 35.3 |
| (2016 forecast) | (18.8) | (36.3) |
| 2016 | 19.2 | 36.5 |
| (2017 forecast) | (20.7) | (40.2) |

**Table A2.2: Annual Activity of Main[1] Aircraft Types at Luton Airport (2010 – 2015)**

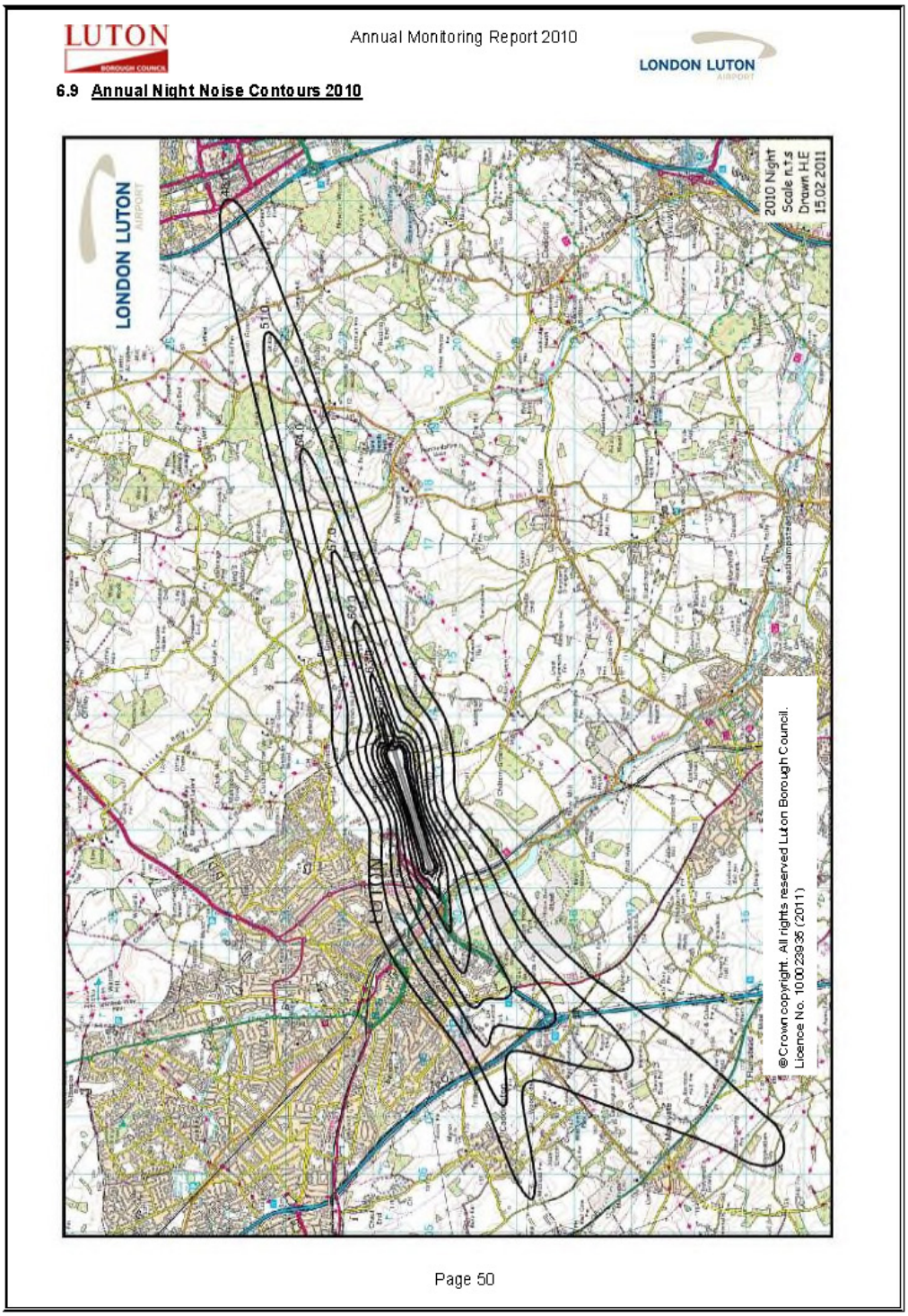
| Airline | Aircraft Type | YEAR | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| easyJet | Boeing 737-700 | 13,266 | 4,403 | - | - | - | - |
| | Airbus A319 | 16,643 | 25,546 | 26,802 | 25,751 | 24,696 | 26,025 |
| | Airbus A320 | 2,514 | 2,863 | 5,718 | 6,449 | 7,934 | 10,827 |
| Wizz Air | Airbus A320 | 12,712 | 15,683 | 16,661 | 17,185 | 20,644 | 25,551 |
| Ryanair | Boeing 737-800 | 8,312 | 9,131 | 9,217 | 9,331 | 8,971 | 9,454 |
| Monarch | Airbus A320 | 1,993 | 2,703 | 1,910 | 1,778 | 2,657 | 2,192 |
| | Airbus A321 | 2,042 | 2,094 | 2,121 | 1,982 | 2,169 | 2,110 |
| Thomson | Boeing 737-800 | 1,497 | 1,436 | 1,503 | 1,676 | 1,666 | 1,605 |
| Flybe | DHC-8 DASH8-400 | 1,036 | (985) | (837) | (512) | - | - |
| Blue Air | Boeing 737-400 | (239) | (631) | 1,046 | (844) | (948) | (872) |
| Aer Arann (Aer Lingus) | ATR 42/72 | 2,628 | 1,010 | (442) | - | - | - |

[1] Main relates to at least 1000 movements annually.

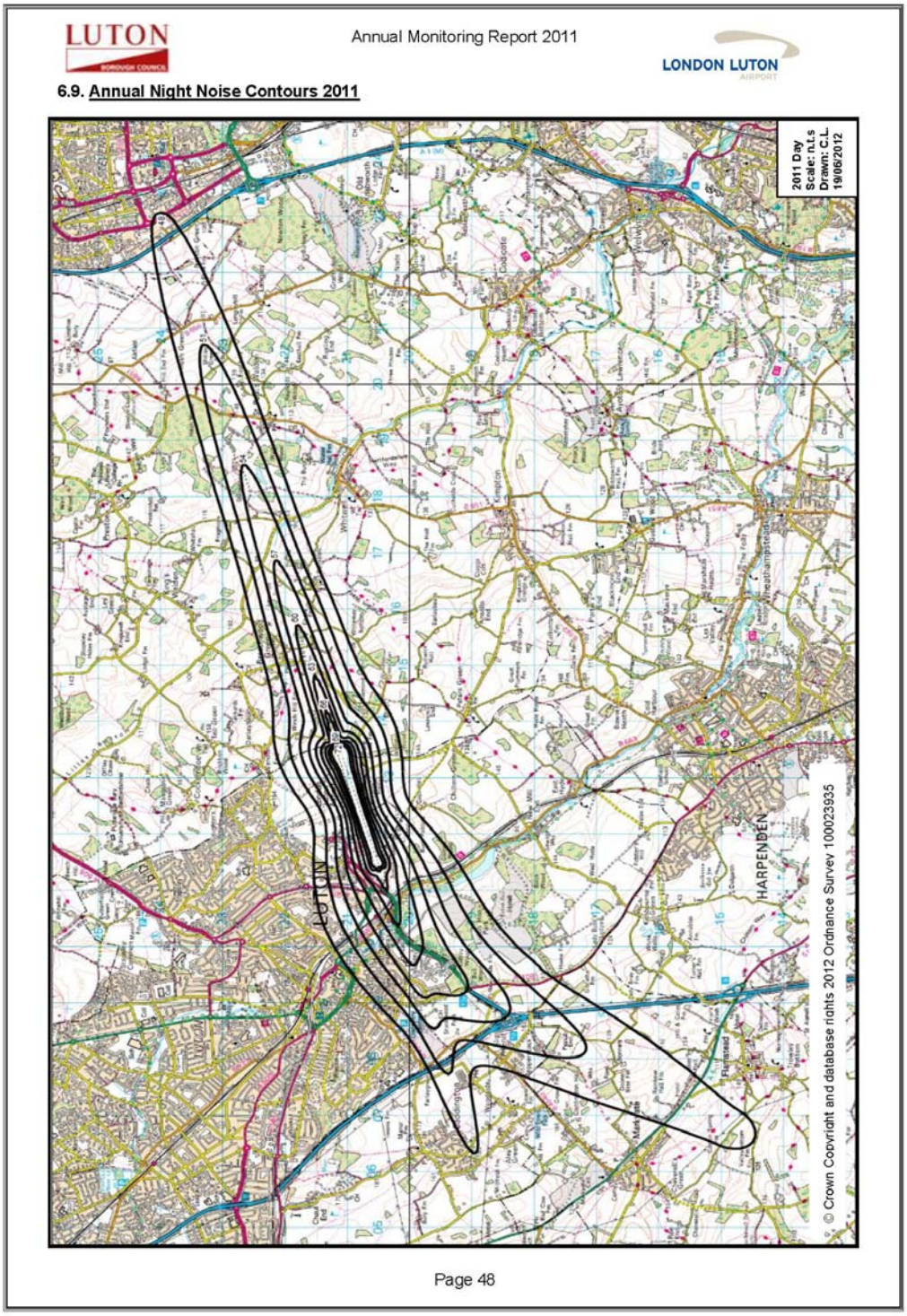
**2010 Daytime**



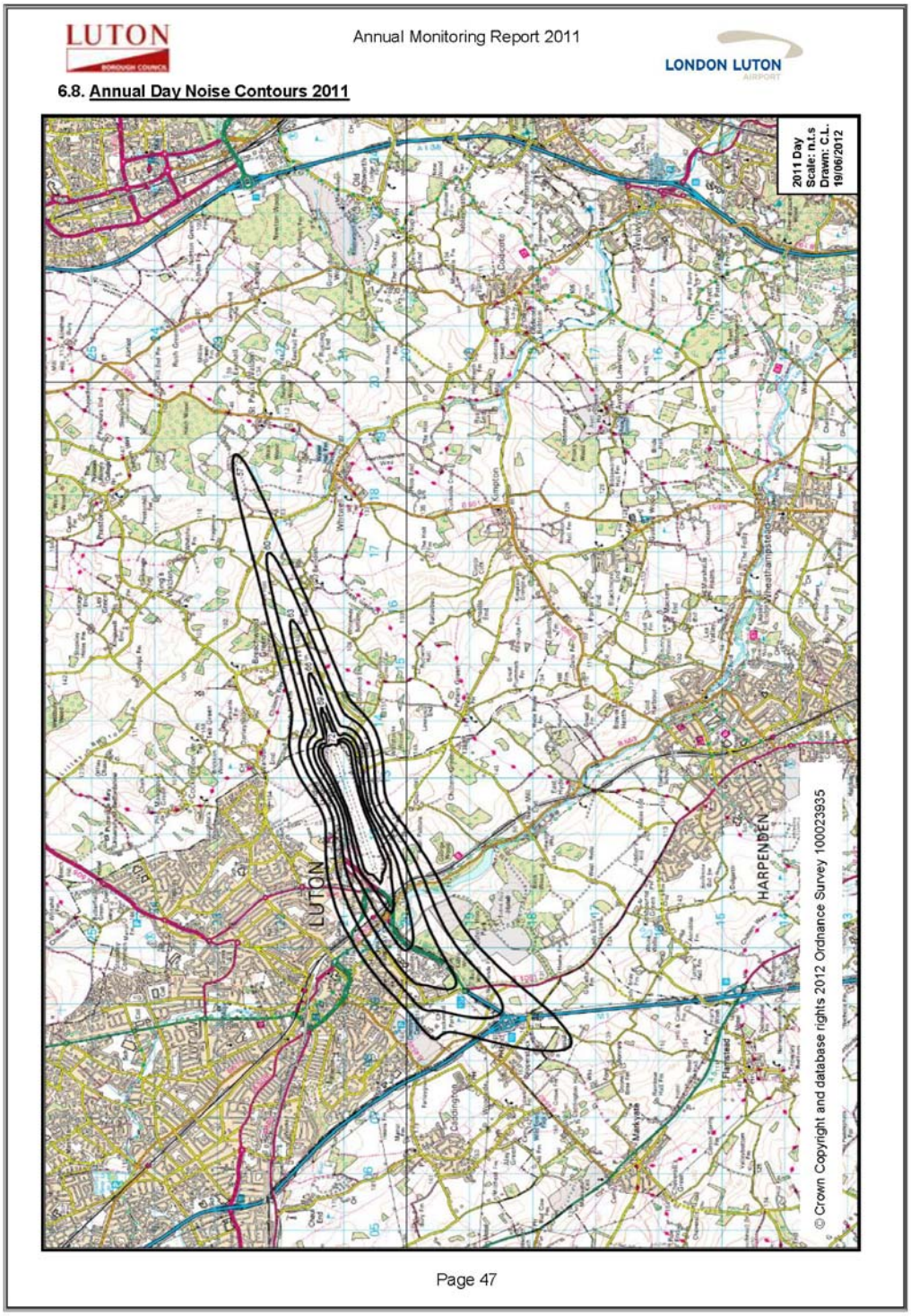
**2010 Night-time**



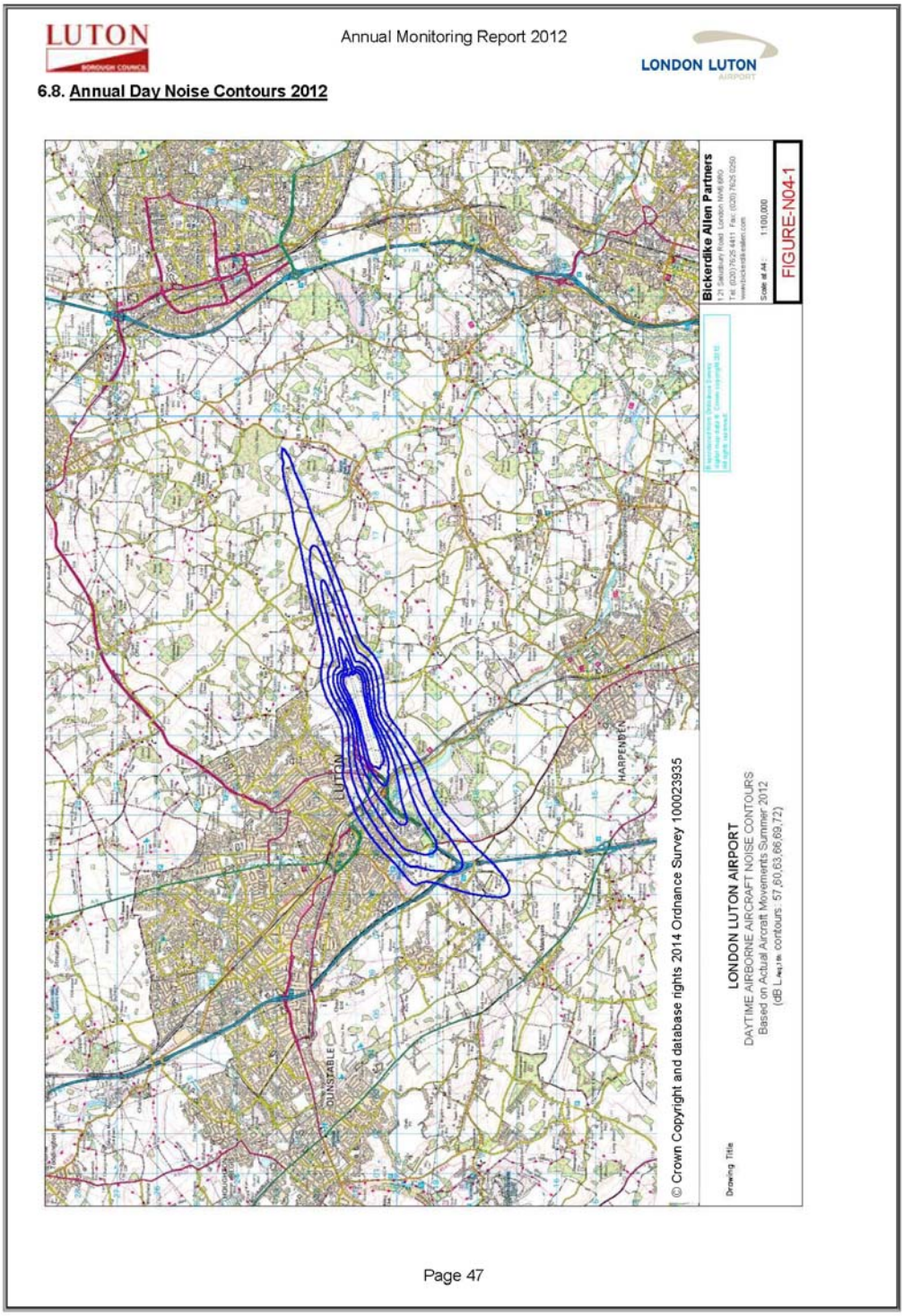
**2011 Daytime**



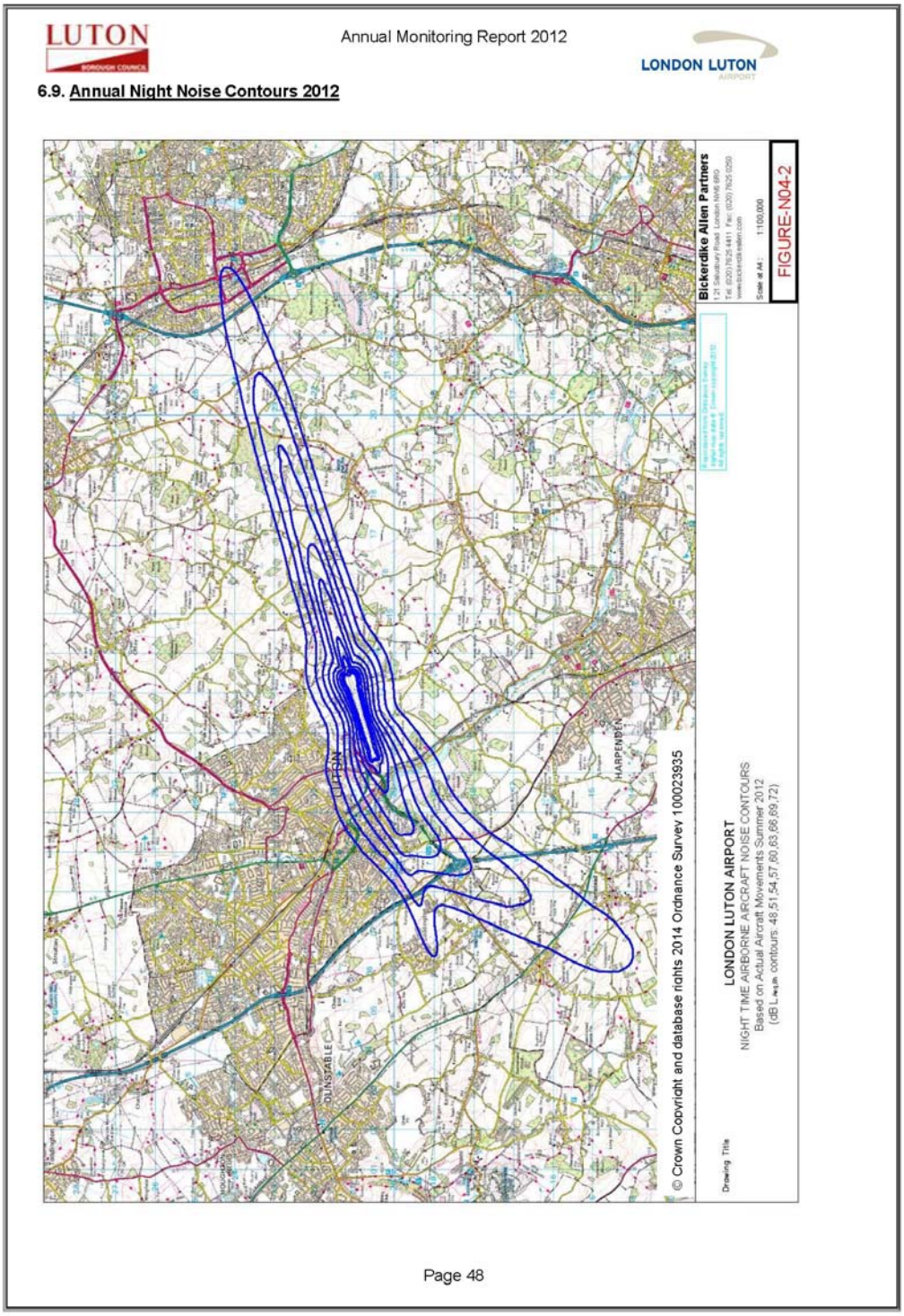
**Night-time 2011**



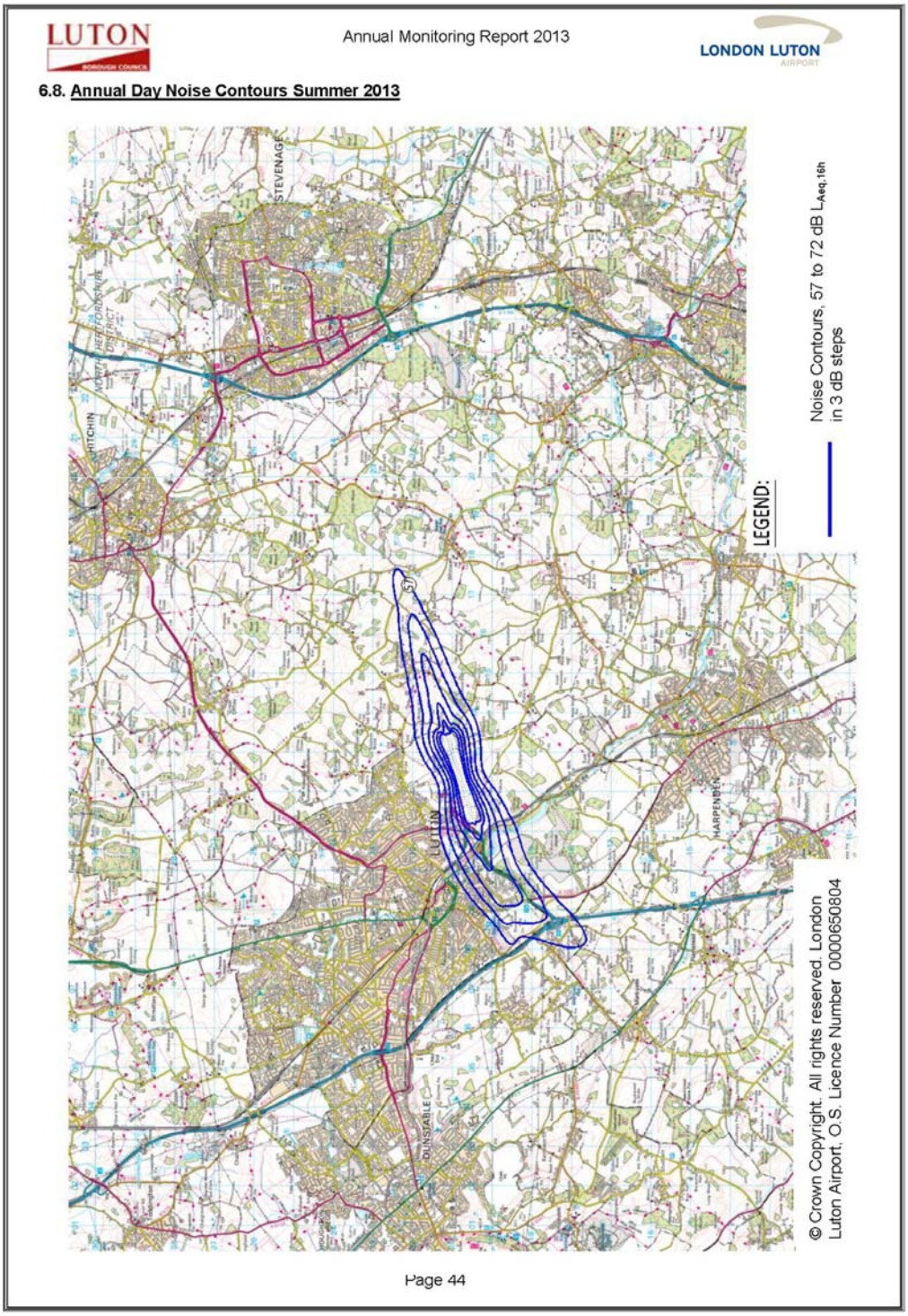
**Daytime 2012**



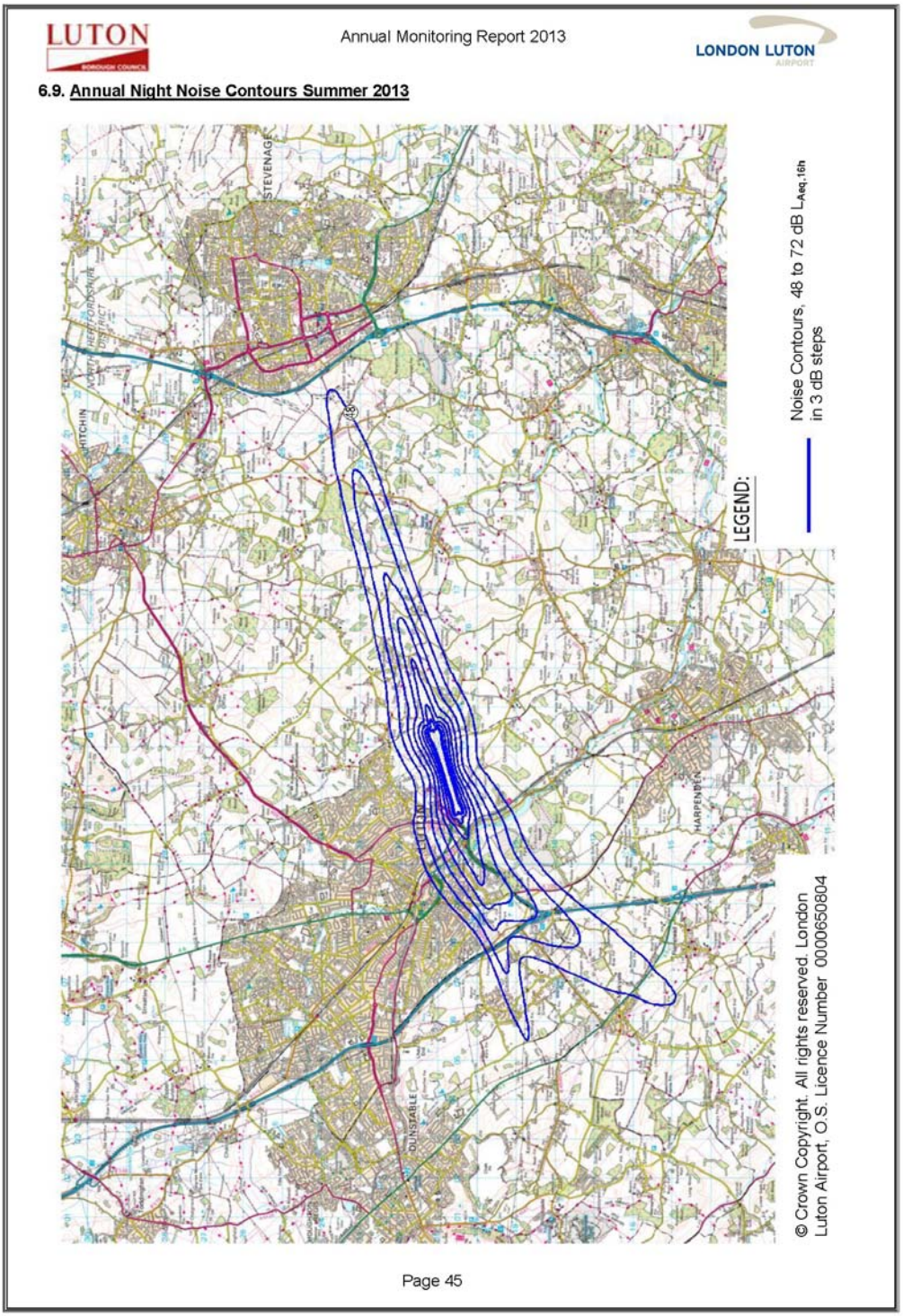
**Night-time 2012**



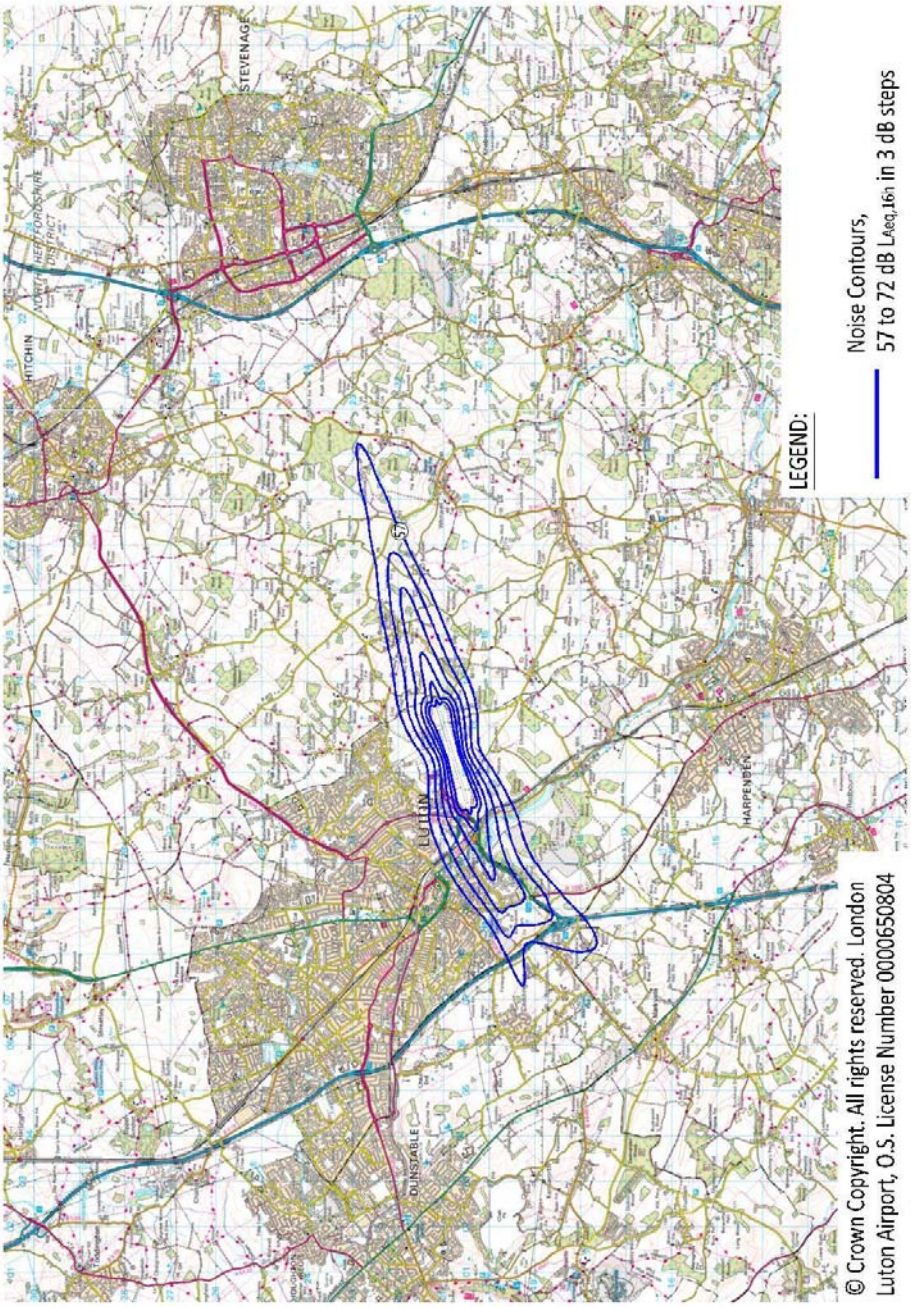
**Daytime 2013**



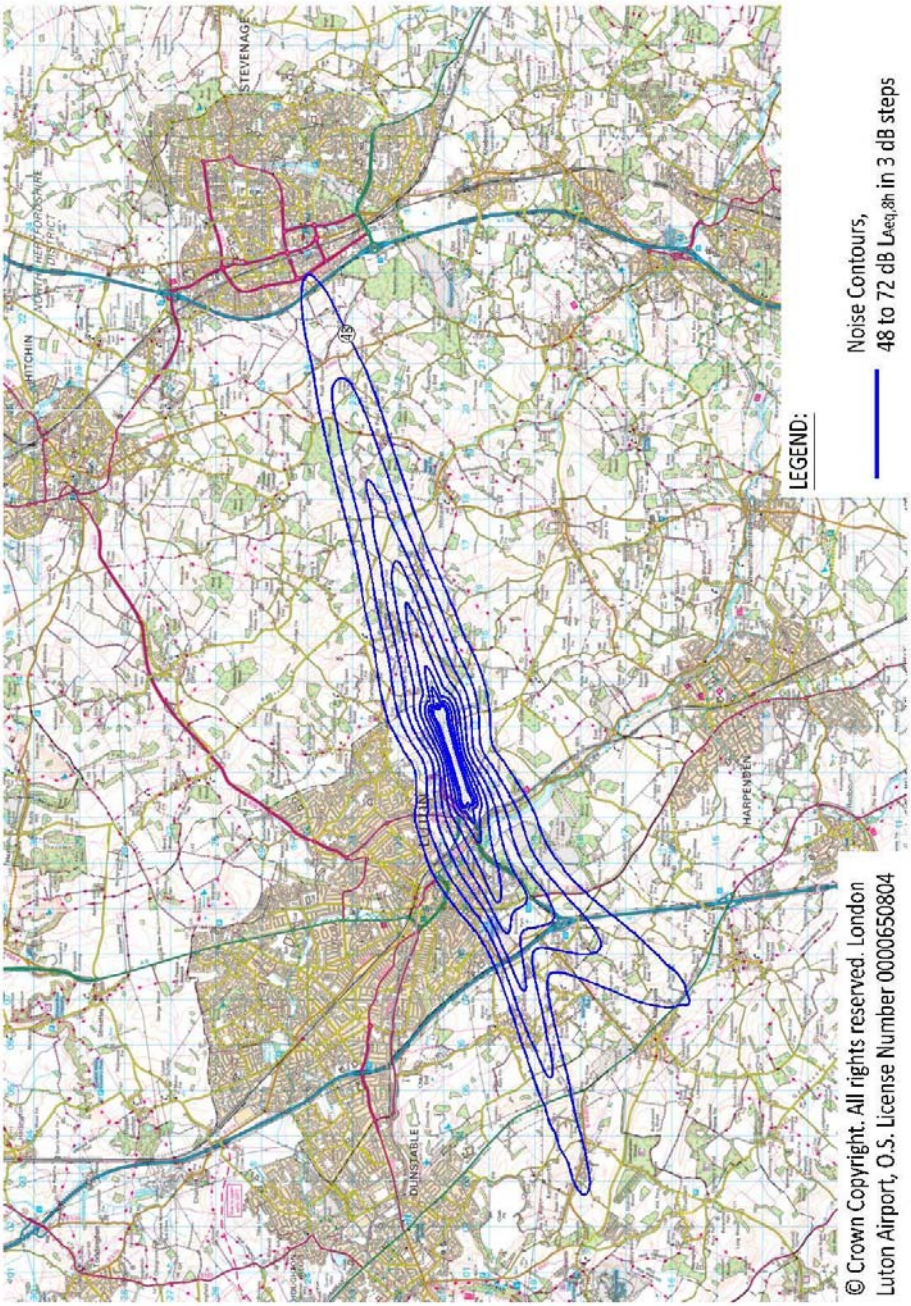
**Night-time 2013**



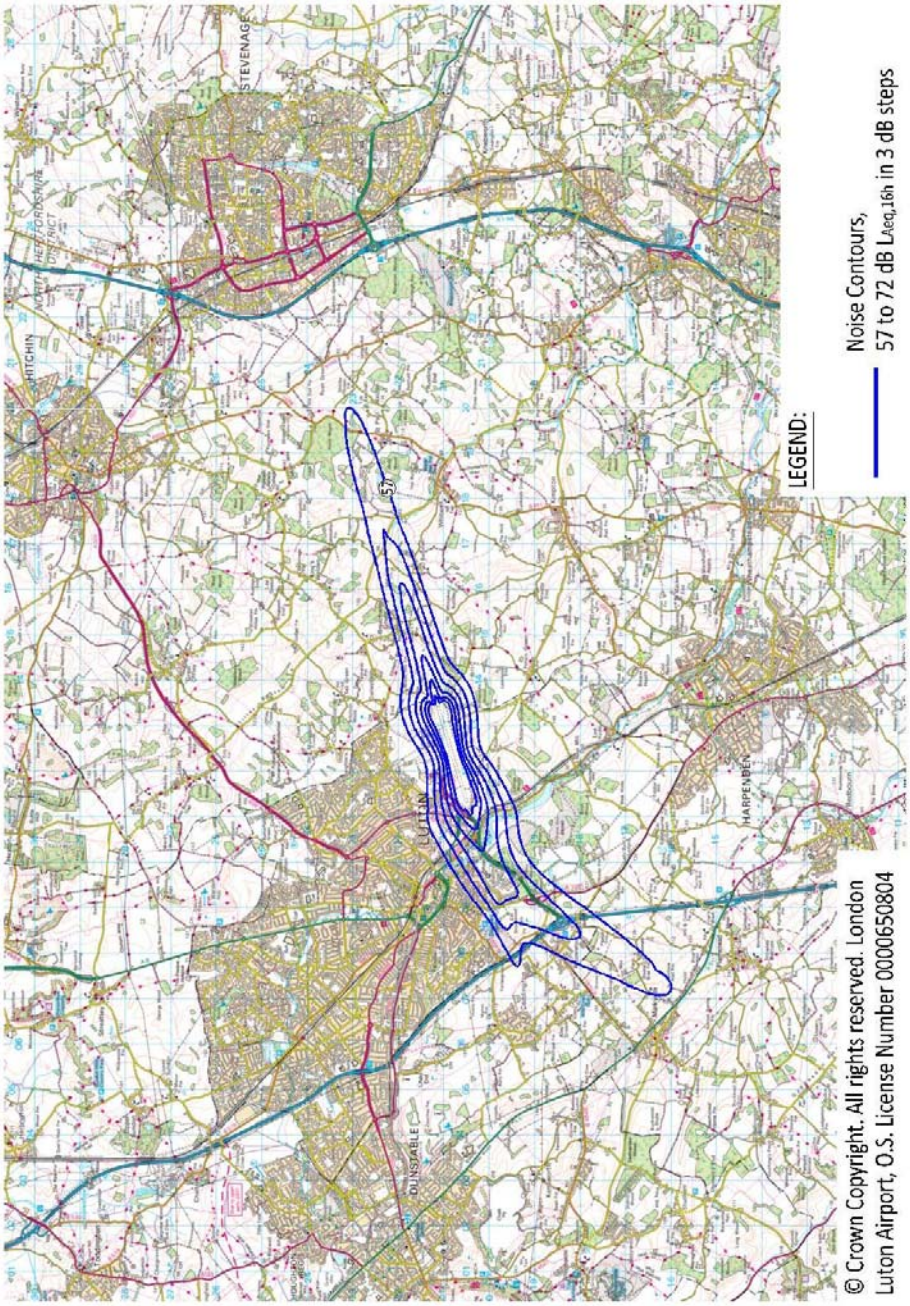
**Daytime 2014**



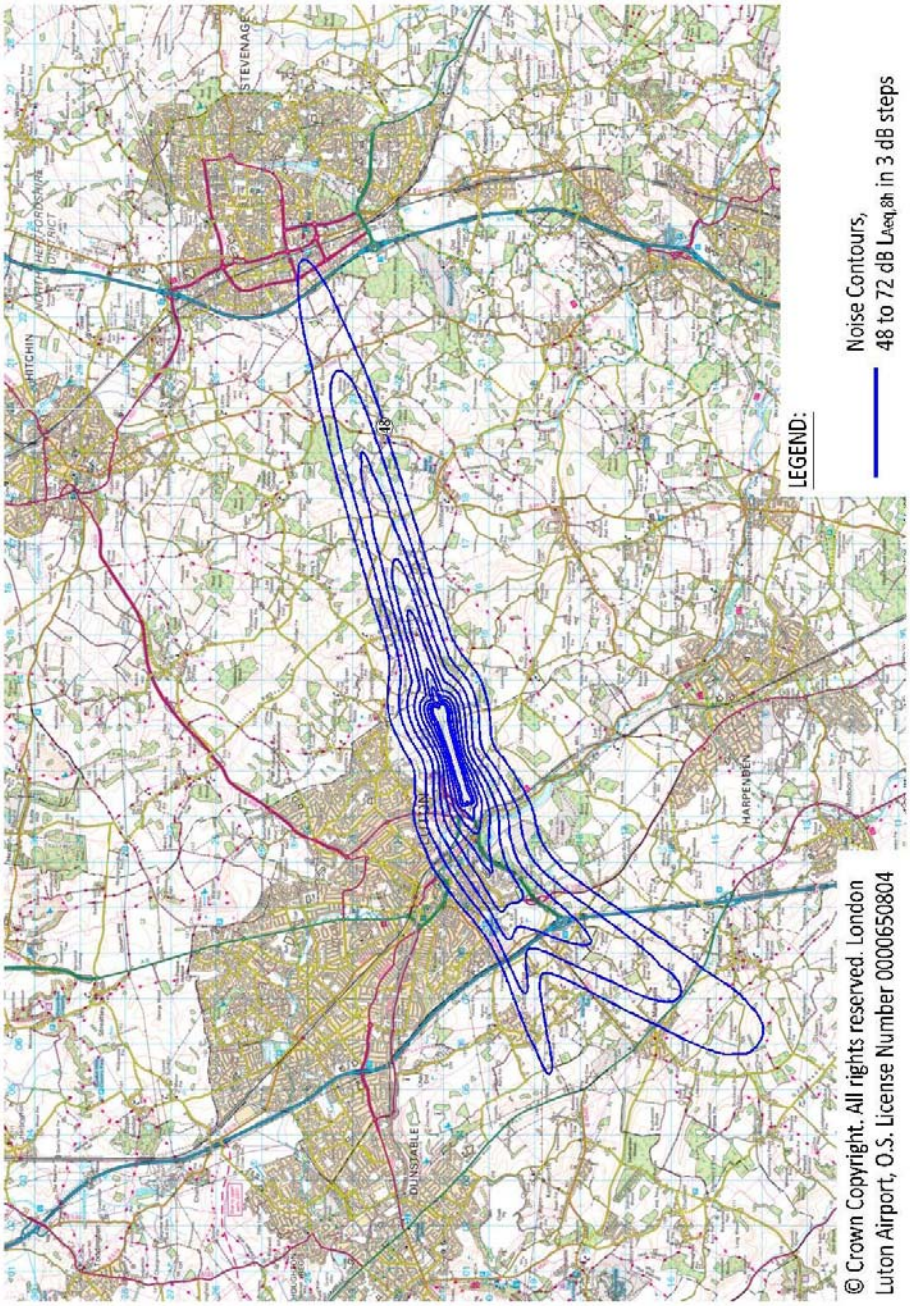
**Night-time 2014**



**Daytime 2015**



**Night-time 2015**



## CONTOURING METHODOLOGY: PAST CONTOURS

### INTRODUCTION

Since the 1st quarter of 2012, London Luton Airport Operations Limited (LLAOL) have retained Bickerdike Allen Partners to produce quarterly night noise contours in accordance with the Night Noise Policy.

The methodology uses the Federal Aviation Administration (FAA) prediction program, the Integrated Noise Model (INM), and the actual number and mix of aircraft, which is supplied by the airport. The methodology is reviewed periodically to ensure that the accuracy of the contours is maintained. A review was completed in 2015 resulting in the 2015 methodology which was used for all the 2015 contours. The main change between this and the previous (2014) methodology is a refinement of the departure profiles of the most common aircraft, based on information provided by easyJet and measured results from the mobile noise monitor while it was stationed in south Luton (Ludlow Avenue). In addition to this, there was the usual annual update of the validation exercise so that it was based on the then most recent set of measured results from the airport's noise and track keeping (NTK) system.

The main assumptions used in the modelling for 2015 are described below, with any changes to the previous methodology highlighted. An assessment is also included of the effect of the update in methodology, which compares contours for the first quarter of 2015 produced under both methodologies.

### SOFTWARE

The 2014 contours were produced using INM version 7.0d, which was released on 30th May 2013. This has been replaced by the FAA with the Aviation Environmental Design Tool (AEDT) as of May 2015. Until this new software has been fully trialled and validated, the earlier INM software has continued to be used.

### ARRIVAL AND DEPARTURE TRACKS

Arrivals are modelled as straight approaches, along the runway centreline. Departure tracks are based on the published Standard Instrument Departures (SIDs) as given in the UK Aeronautical Information Publication (AIP). There are three modelled departure tracks from each runway end; one to Compton, one to Olney, and one to Match/Detling. The movement data supplied by the airport gives details of departure tracks. These assumptions are identical to those used for the previous methodology.

### LOCAL TERRAIN

Local terrain has been included in the model, as it was in the previous methodology.

**STAGE LENGTH**

In the INM software, departure profiles and weight are determined by the stage length parameter, which categorises aircraft based on the distance to their destinations. Destination information has been used to determine departure weights, as was the case in the previous methodology.

**DEPARTURE PROFILES AND UPDATE OF VALIDATION**

Measured results from the mobile noise monitor while it was stationed in south Luton (Ludlow Avenue), given in Table A2.1, indicated that the 2014 methodology was significantly overestimating the noise levels produced by the three most common aircraft types at this location by around 4 dB(A) SEL, although the modelled noise levels at the fixed noise monitors agreed with the measured levels.

As a result, BAP investigated the reason for the discrepancy. Reviewing detailed data from the airport's NTK system showed that the actual departure profile did not match what was being modelled, so more information was sought from airlines. easyJet were able to provide some detailed information regarding typical profiles achieved by their Airbus A319 and A320 aircraft. In summary, their aircraft cut back to a lower thrust setting earlier, and climb to 3,000 feet later than previously assumed. The modified profile has the effect of significantly reducing the predicted noise level close to the airport, but has a smaller effect at more distant locations.

For the Boeing 737-800 aircraft, no information was received from the operators. However, using a modified profile similar to those used for the two Airbus aircraft resulted in much better agreement with the measured results at the south Luton location, while not changing the modelled noise levels at the fixed noise monitors significantly. Therefore, it was assumed that the Boeing 737-800 also follows a similar profile.

As can be seen in Table A2.1 using the updated methodology has significantly improved the accuracy at the south Luton location, reducing the predicted noise levels by 3-4 dB(A) and therefore significantly reducing the modelled overestimation.

**Table A2.1: Comparison of Measured Sound Exposure Levels – South Luton**

| Aircraft Type | Operation | South Luton NMT Noise Level, SEL dB(A) | | |
|---|---|---|---|---|
| | | Measured Average[1] | INM Prediction (2014 Methodology) | INM Prediction (2015 Methodology) |
| Airbus A319 | Departure | 87.8 | 92.1 | 88.4 |
| Airbus A320 | Departure | 87.6 | 92.5 | 88.8 |
| Boeing 737-800 | Departure | 90.3 | 93.0 | 90.0 |

[1] Arithmetic average of measurements.

The validation exercise undertaken by BAP was also updated so that it is based on a later set of annual measured results from the airport's NTK system. For the most common and loudest aircraft types the previous validation exercise, which used 2013 measured data, was updated. This was based on measured results in 2014. The measured sound exposure levels (SELs) obtained for the three main aircraft types operating at Luton Airport, the Airbus A319 and A320 and the Boeing 737-800, from the fixed Noise Monitoring Terminals (NMTs) in 2013 and 2014 are shown in Table A2.2.

**Table 2.2: Comparison of Measured Sound Exposure Levels – Fixed NMTs**

| Aircraft Type | Operation | Movement-Weighted NMT Noise Level, SEL dB(A) | | |
|---|---|---|---|---|
| | | 2013 Average[1] | 2014 Average[1] | Validated INM Prediction |
| Airbus A319 | Arrival | 84.3 | 84.4 | 84.5 |
| | Departure | 84.2 | 84.4 | 84.3 |
| Airbus A320 | Arrival | 84.1 | 84.1 | 85.1 |
| | Departure | 84.5 | 84.8 | 84.9 |
| Boeing 737-800 | Arrival | 85.6 | 85.5 | 86.5 |
| | Departure | 85.4 | 85.6 | 85.1 |

[1] Only NMT1 results used for arrivals. NMT2 and NMT3 given half weighting as each movement typically results in 2 measured noise events. (All averages based at least 1000 results)

The measured noise levels remained consistent from 2013 to 2014, and therefore for arrivals the validated noise levels did not change. With the modified departure profiles, after the validation correction the validated noise levels at the fixed NMTs are similar to the previous methodology. This is despite a decrease in noise levels at the south Luton location of 3-4 dB(A), which has greatly improved the accuracy at that location.

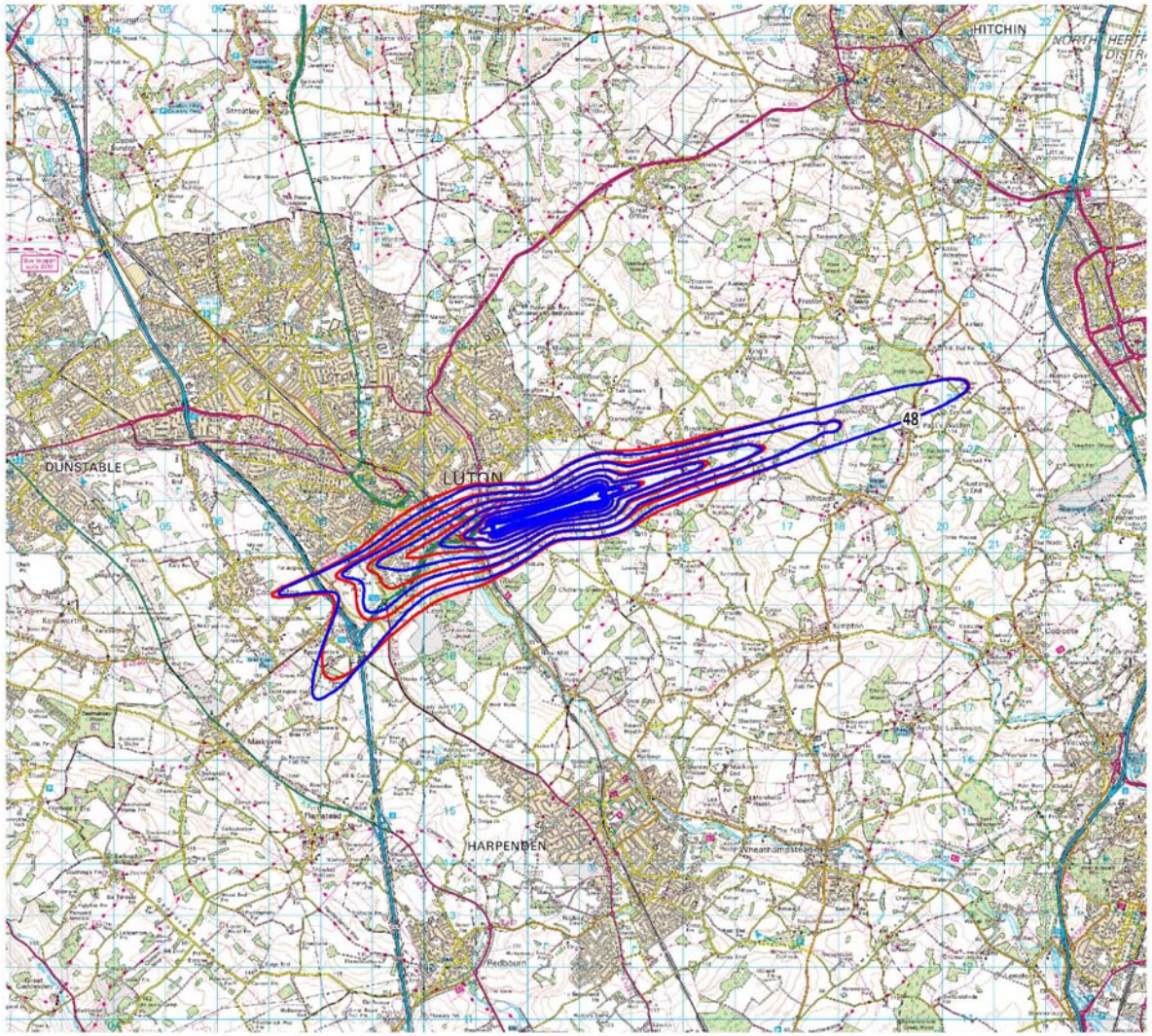
Some minor changes were made to other aircraft types, which are not expected to have a significant effect on the noise contours.

**CONTOUR COMPARISON**

The contours for quarter 1 of 2015 were computed using both methodologies and are compared in Figure A9457-N15-01. The areas are given in Table A2.3. The methodology update results in a decrease in the area of the contours, in particular in the 51-57 dB $L_{Aeq,8h}$ range. This is because the updated departure profiles for the three most common aircraft are initially very similar to the previous ones, but then reduce thrust earlier, resulting in significantly reduced noise levels in that area. Once the aircraft reach 3,000 ft, the updated profiles are again similar to the previous ones.

**Table A2.3: Comparison of Night Time Noise Contour Areas**

| Contour Value (dB $L_{Aeq,8h}$) | Jan – Mar 2015 Contour Area ($km^2$) | | |
|---|---|---|---|
| | 2014 Methodology | 2015 Methodology | Change (%) |
| 48 | 16.9 | 15.9 | -6% |
| 51 | 9.4 | 8.3 | -12% |
| 54 | 5.4 | 4.6 | -15% |
| 57 | 2.8 | 2.4 | -14% |
| 60 | 1.4 | 1.4 | -6% |
| 63 | 0.9 | 0.8 | -4% |
| 66 | 0.6 | 0.5 | -3% |
| 69 | 0.4 | 0.3 | -3% |
| 72 | 0.2 | 0.2 | -4% |






LEGEND:

Noise Contours (2014 Method), 48 to 72 dB $L_{Aeq,8h}$ in 3 dB steps

Noise Contours (2015 Method), 48 to 72 dB $L_{Aeq,8h}$ in 3 dB steps

REVISIONS

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London Luton Airport
Regular Contouring

Airborne Aircraft Noise Contours
Jan-Mar 2015 Average Night time
Methodology Comparison

DRAWN: NW CHECKED: DC

DATE: 14/08/2015 SCALE: 1:100000@A4

FIGURE No:

A9457/N15/01

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Architecture Acoustics Technology

# APPENDIX 3

## Current and Future Noise Contours and Methodology

- Table A3.1: Recent Passenger Growth and Aircraft Activity (2010-2016)
- Table A3.2: Possible Future Annual Passenger Activity
- Table A3.3: Future Passengers in E.S. Compared to Now Possible (10% annual growth)
- Table A3.4: Future Re-engined Aircraft [First Flight/Service Entry]
- Table A3.5: Aircraft Activity Compatible with 18mppa
- Contouring Methodology: Current and Future Contours

**Table A3.1: Recent Passenger Growth and Aircraft Activity (2010-2016)**

| Year | Passengers (mppa) | % Growth in Passengers | Total Aircraft Movements | Commercial Passenger Movements | Non-commercial General Aviation Movements |
|---|---|---|---|---|---|
| 2010 | 8.8 | - | 95,628 | 71,983 | 16,298 |
| 2011 | 9.5 | 8% | 99,299 | 75,278 | 16,480 |
| 2012 | 9.6 | 1% | 98,763 | 74,976 | 16,111 |
| 2013 | 9.7 | 1% | 97,615 | 74,071 | 15,919 |
| 2014 | 10.5 | 8% | 103,939 | 79,171 | 16,831 |
| 2015 | 12.3 | 16% | 116,412 | 91,154 | 16,370 |
| 2016 | 14.6 | 19% | 131,435 | 104,802 | 19,120 |

N.B Information from published Luton Airport reports.

**Table A3.2: Possible Future Annual Passenger Activity**

| Year | Annual Passengers (mppa) by Assumed Growth Rate from 2016 | | | |
|---|---|---|---|---|
| | 3.6%[1] | 5%[2] | 10%[2] | Provisional Forecast |
| 2016 | 14.6 | 14.6 | 14.6 | 14.6 |
| 2017 | 15.1 | 15.3 | 16.1 | 15.7 |
| 2018 | 15.7 | 16.1 | 17.7 | 16.6 |
| 2019 | 16.2 | 16.9 | 18.0[+] | 17.5 |
| 2020 | 16.8 | 17.7 | 18.0[+] | 18.0[+] |
| 2021 | 17.4 | 18.0[+] | 18.0[+] | 18.0[+] |
| 2022 | 18.0[+] | 18.0[+] | 18.0[+] | 18.0[+] |
| 2023 | 18.0[+] | 18.0[+] | 18.0[+] | 18.0[+] |

[1] 3.6% Compound Average Rate Growth of UK passengers, 1990-2012.

[2] Low Cost Sector growth 5-12% between 1997 and 2005.

[+] Current Planning Limit on Airport (Planning Condition 10)

N.B. Annual Growth Rate for LLA L.C. Operators (2015):
easyJet 15%, Wizz Air 28%, Ryanair 28%.

N.B. LLA Annual Average Annual Growth (2010 – 2016) 9%.
LLA Annual Growth [2016] 19%.

**Table A3.3: Future Passengers in E.S. Compared to Latest Provisional Forecast**

| YEAR | Passengers (mppa) | |
|---|---|---|
| | Latest Provisional Forecast | E.S. Assumptions |
| 2015 | 12.3 Actual | 11.2 |
| 2016 | 14.6 Actual | 11.7 |
| 2018 | 16.6 | 12.6 |
| 2020 | 18.0[+] | 13.4 |
| 2022 | 18.0[+] | 14.8 |
| 2024 | 18.0[+] | 15.8 |
| 2026 | 18.0[+] | 17.3 |
| 2028 | 18.0[+] | 17.8 |

[+] Current Planning Limit on Airport (Planning Condition 10)

**Table A3.4: Future Re-engined Aircraft [First Flight/Service Entry]**

| Future Re-engined Aircraft | First Flight | Actual Service Entry (estimated) |
|---|---|---|
| **AIRBUS A320 Family** | | |
| A319neo | Mar 2017 | (2018) |
| A320neo | Sept 2014 | Jan 2016 |
| A321neo | Feb 2016 | April 2017 |
| A321 LR | ? | (2019) |
| **B737 MAX Family** | | |
| MAX 7 (replaces 737-700) | ? | ? |
| MAX 8 (replaces 737-800) | Jan 2016 | May 2017 |
| MAX 200 (Max 8 with more seats) | ? | (2019) |
| MAX 9 (replaces 737-900) | Apr 2017 | (2018) |

Ordered by Luton main airlines:

| | |
|---|---|
| A320neo (easyJet) (100 of) | (deliveries from 2017 to 2022) |
| A321neo (easyJet) (30 of) | (deliveries from 2018 ?) |
| A321neo (Wizz Air) (110 of) | (deliveries from 2019 to 2024) |
| A320neo (Vueling) (47 of) | (deliveries up to 2020) |
| B737 MAX200 (Ryanair) (100 of) | (deliveries from 2019 - …) |
| B737 MAX 8 (Monarch) (30 of) | (deliveries from Q2 2018) |
| B737 MAX 8 (TUI) (40 of) | (deliveries from 2018 – 2023) |

| | | |
|---|---|---|
| [N.B. | Bombardier “C” Series | (delivered July 2016) |
| | Embraer “E2” Series | (first flight 2016, service entry 2018) |
| | Airbus A320neo | (In service, 68 delivered in 2016) |
| | Irkut MC-21 | (First flight 2017, service entry 2018)] |

**Table A3.5: Aircraft Activity Compatible with 18 mppa – E.S.**

| Aircraft Types | Summer Movements |
|---|---|
| **PASSENGER** | |
| Airbus A319 | 10,482 |
| Airbus A320 | 13,071 |
| Airbus A321 | 2,450 |
| Boeing 737-400 | - |
| Boeing 737-800 | 8,478 |
| Boeing 777 | 158 |
| Boeing 787 | 552 |
| Embraer 190 | 1,262 |
| (Sub-Total) | (36,453) |
| **CARGO** | |
| Boeing 737-700 | 52 |
| Boeing 757F | 156 |
| Airbus A300/310 | 572 |
| ATP | 156 |
| (Sub-Total) | (936) |
| **BUSINESS A/C** | |
| Cessna 525 | 4,286 |
| Cessna 56X | 2,142 |
| Challenger 605 | 2,140 |
| Gulfstream 550 | 2,568 |
| (Sub-Total) | (11,136) |
| **All Total** | 48,525 |

**Table A3.6: Aircraft Activity Compatible with 18 mppa – Post E.S.**

| Aircraft Types | Summer Movements |
|---|---|
| **PASSENGER** | |
| Airbus A319 | 6,289 |
| Airbus A320 | 14,378 |
| Airbus A321 | 5,513 |
| Boeing 737-400 | - |
| Boeing 737-800 | 8,478 |
| Boeing 777 | 158 |
| Boeing 787 | 552 |
| Embraer 190 | 92 |
| (Sub-Total) | (35,460) |
| **CARGO** | |
| Boeing 737-700 | 52 |
| Boeing 757F | 156 |
| Airbus A300/310 | 572 |
| ATP | 156 |
| (Sub-Total) | (936) |
| **BUSINESS A/C** | |
| Cessna 525 | 4,286 |
| Cessna 56X | 2,142 |
| Challenger 605 | 2,140 |
| Gulfstream 550 | 2,568 |
| (Sub-Total) | (11,136) |
| **All Total** | 47,532 |

## CONTOURING METHODOLOGY: CURRENT AND FUTURE CONTOURS

### INTRODUCTION

The detailed noise input data and methodology for the E.S. contours was set out in Appendix N03 of the E.S. Appendix H. The methodology was similar to that used for the past contours, as described in Appendix 2 of this report. It did however differ in that it used an earlier version of the INM modelling software, and that the validation involved was based only on data at the fixed noise monitors of the airport's NTK system. It therefore did not allow for the data subsequently obtained from South Luton.

For the latest current and future contours for the Worst Intermediate Year (W.I.Y.) and the effect of fleet modernisation upon it, the main assumptions used in the modelling are described below.

### SOFTWARE

The contours were produced using the Federal Aviation Administration (FAA) prediction program, the Integrated Noise Model (INM) version 7.0d, and the forecast number and mix of aircraft, which was supplied by the airport either for the E.S., as detailed in Table A3.5, or subsequently to reflect ongoing developments, as detailed in Table A3.6.

### ARRIVAL AND DEPARTURE TRACKS

Arrivals are modelled as straight approaches, along the runway centreline. Departure tracks are based on the published Standard Instrument Departures (SIDs) as given in the UK Aeronautical Information Publication (AIP). There are three modelled departure tracks from each runway end; one to Compton, one to Olney, and one to Match/Detling. The forecast data supplied by the airport gives details of departure tracks.

For the current contours the actual runway usage for each movement has been used. For the future contours the runway use is based on the long term summer period average for 2007 to 2011, as was used for the production of the E.S. contours.

### LOCAL TERRAIN

Local terrain has been included in the model.

### STAGE LENGTH

In the INM software, departure profiles and weight are determined by the stage length parameter, which categorises aircraft based on the distance to their destinations. Destination information for the actual movements or contained in the forecasts has been used to determine departure weights.

**DEPARTURE PROFILES AND UPDATE OF VALIDATION**

The results from the latest validation exercise, which took into account both the measured noise levels from the fixed monitors of the airport's NTK system in 2015, and the results from the mobile monitor when it was deployed in South Luton, have been used. These are similar to those detailed in Appendix 2, and include the revised departure profiles for the three main aircraft types operating at Luton Airport.

The measured sound exposure levels (SELs) obtained for the three main aircraft types operating at Luton Airport, the Airbus A319 and A320 and the Boeing 737-800, from the fixed Noise Monitoring Terminals (NMTs) in 2014 and 2015 are shown in Table A3.7.

**Table A3.7: Comparison of Measured Sound Exposure Levels – Fixed NMTs**

| Aircraft Type | Operation | Movement-Weighted NMT Noise Level, SEL dB(A) | | |
|---|---|---|---|---|
| | | 2014 Average[1] | 2015 Average[1] | Validated INM Prediction |
| Airbus A319 | Arrival | 84.4 | 84.4 | 84.5 |
| | Departure | 84.4 | 84.3 | 84.6 |
| Airbus A320 | Arrival | 84.1 | 84.1 | 84.2 |
| | Departure | 84.8 | 84.5 | 84.5 |
| Boeing 737-800 | Arrival | 85.5 | 85.5 | 86.5 |
| | Departure | 85.6 | 85.7 | 85.0 |

The measured noise levels have remained consistent from 2014 to 2015. For the Airbus A319 and Boeing 737-800, no changes were made to the validation. For the Airbus A320, this has historically been modelled using the A320-232 variant, which most closely matches the variant operated by easyJet. However, the majority of the movements are carried out by Wizz, who operate the A320-214 variant, which would be modelled using the A320-211. Therefore a check was made to see whether the A320-211 variant improved the predictions. For arrivals, this was the case, and so the A320-211 has been used. For departures a large correction would have been needed, so the A320-232 has continued to be used. The correction factor was however modified, as the measured noise levels had slightly decreased.

**MODERNISATION**

Future contours have been produced which assume a degree of fleet modernisation. This modernisation has been restricted to the movements by the Airbus A320, Airbus A321, and Boeing 737-800. Under the *partial fleet modernisation (25%)* scenario one quarter of the movements by these aircraft have been assumed as by modernised types. Under the *fleet modernisation (100%)* scenario all of the movements by these aircraft have been assumed as by modernised types.

This differs from the E.S. contours when the under the *partial modernisation (50%) scenario* half of the movements by these aircraft were assumed as by modernised types. For the E.S. scenario the Airbus A319 was also modernised, as Airbus are producing a modernised replacement for the Airbus A319, the Airbus A319neo. However, given relatively poor sales of this derivative, and in particular the absence of orders for it from based operators at London Luton Airport (LLA), for the latest scenarios no modernisation has been assumed. Instead in the latest forecasts activity by this type reduced, and has been replaced by activity by larger but modernised types.

For the E.S. the assumed performance of the modernised types was an improvement of 3 dB(A) on the types that they replace both on arrival and on departure. So the Airbus A320neo was taken as 3 dB(A) quieter than the Airbus A320, the Airbus A321neo was taken as 3 dB(A) quieter than the Airbus A321, and the Boeing 737 MAX 8 was taken as 3 dB(A) quieter than the Boeing 737-800.

Given these types have not yet commenced operations at LLA there remains some uncertainty over their in service performance. Since the E.S. the aircraft types have however achieved international certification. The latest predictions therefore consider two levels of modernisation performance; that used for the E.S. as described above, and an alternative based on the recent certification data. The certification data finds a consistently greater benefit on departure so a 5 dB(A) reduction has been used for each aircraft type. On arrival the certification data finds a similar level of improvement, although it does suggest that for the Airbus A321neo the benefit may be slightly less and so a 2 dB(A) reduction has been used.

# APPENDIX 4

## Future Individual Aircraft Characteristics

**Table A4.1: Noise Characteristics of Main Aircraft Types at Luton Airport (Examples)**

| Aircraft Type | Noise Certification Values (EPNL dB) | | | | |
|---|---|---|---|---|---|
| | Take-off Mass Kg (1000's) | Lateral | Flyover | Approach | Combined |
| **Current Fleet** | | | | | |
| Boeing 737-800 | | | | | |
| Ryanair | 67 | 94.4 | 82.3 | 96.3 | 273 |
| Thomson | 79 | 94.5 | 85.9 | 96.4 | 277 |
| Airbus A319 | | | | | |
| easyJet | Various | 91.7 | 82.6 | 93.9 | 268 |
| | | Average quoted | | | |
| Airbus A320 | | | | | |
| easyJet | 77 | 92.9 | 84.8 | 95.2 | 273 |
| easyJet | 73.5 | 93.6 | 83.7 | 95.5 | 273 |
| Monarch | 77 | 92.9 | 85.3 | 94.2 | 273 |
| Monarch | 77 | 93.5 | 85.3 | 95.5 | 274 |
| Wizz Air | 73.5 | 91.4 | 82.5 | 94.2 | 268 |
| Airbus A321 | | | | | |
| Thomas Cook[1] | 93.5 | 95.9 | 88.3 | 96.5 | 281 |
| Monarch | 93.5 | 95.0 | 88.3 | 95.6 | 279 |
| **Other Current Single-aisle Passenger Types** | | | | | |
| Boeing 737-700 | 65 | 90.6 | 85.7 | 95.8 | 272 |
| Boeing 737-400 | 65 | 93.2 | 85.9 | 100.2 | 279 |
| | 68 | 93.1 | 87.1 | 100.2 | 280 |
| Embraer 190 | 52 | 92.4 | 84.9 | 92.6 | 270 |
| **Business Aircraft** | | | | | |
| Cessna 525 | 5 | 83.7 | 73.4 | 92.1 | 249 |
| Gulfstream 550 | 41 | 89.8 | 80.3 | 90.8 | 261 |
| Challenger 605 | 22 | 86.2 | 80.9 | 90.3 | 257 |
| Cessna 56X | 9 | 85.3 | 72.4 | 93.1 | 251 |
| **Re-engined Types** | | | | | |
| Airbus A320neo | | | | | |
| (Latest Single Aisle Narrow | 73.5 | 87.3 | 79.4 | 92.0 | 259 |
| Bodied Transport) | 73.5 | 85.9 | 79.8 | 92.4 | 258 |
| Airbus A321neo | 77 | 85.8 | 80.9 | 92.6 | 259 |
| | 93.5 | 88.8 | 85.2 | 94.4 | 268 |
| Boeing 737 MAX 8 | 79 | 87.5 | 83.2 | 94.2 | 265 |
| Bombardier C Series | | | | | |
| (New Aircraft type) | 60 | 87.9 | 79.0 | 91.9 | 259 |

[1] Recently acquired new aircraft.

# APPENDIX 5
## Revised Planning Condition 12

*The area enclosed by the 57dB(A) Leq16hr (0700-2300) contour shall not exceed 24.0 sq km for the daytime noise, and the area of the transitional 48dB(A) Leq8hr (2300-0700) contour shall not exceed 51.7 sq km for the night-time noise, when calculated by the Federal Aviation Administration Integrated Noise Model version 7.0.d (or as may be updated or amended). The following additional noise reduction measures shall be carried out in accordance with the Noise Contour Limits: Transitional Arrangement report prepared by Bickerdike Allen Partners LLP (reference: A9501-R06D//A11060/04/R01) and the airport shall not be operated otherwise than in accordance with these measures:*

a) *Introduce a published 10% differential for landing fees of re-engined aircraft (e.g. Airbus Neo's) from 1st April 2018 (the next tariff publication date) and thereafter maintain this 10% differential unless otherwise agreed by the Local Planning Authority.*

b) *Introduce a published 10% differential for landing fees of Chapter 14 aircraft from 1st April 2018 (the next tariff publication date) and thereafter maintain this 10% differential unless otherwise agreed by the Local Planning Authority.*

c) *With effect from 31st January 2018 up to and including 31st January 2023 to ensure that the account balance for the Noise Insulation Fund as at 31 January each year is 15% above the amount required under the Section 106 Agreement dated [ ] between London Luton Airport Operations Limited (1) London Luton Airport Limited (2) The Royal Bank of Scotland plc (3) and Luton Borough Council (4).*

*Within 6 months of the date of this permission, a detailed scheme (Contour Reduction Scheme) shall be submitted to the Local Planning Authority for approval in writing which defines the methods to be used by LLAOL or any successor airport operator to reduce the area of the noise contours by 2025 for daytime noise to 15.2 sq km for the area exposed to 57 dB(A) Leq16hr (0700-2300) and above and for night-time noise to*

*31.6 sq km for the area exposed to 48 dB(A) Leq8hr (2300-0700) and above. The Contour Reduction Scheme shall include:*

a) *a programme for monitoring actual aircraft noise levels;*

b) *a procedure for verifying the area of the modelled daytime and night-time noise contours annually against actual aircraft noise levels;*

c) *an annual review of the Contour Reduction Scheme and its effectiveness in reducing the area of the daytime and night-time noise contours (including any proposed changes to the scheme to address the findings of the review) which shall be submitted to and approved in writing by the local planning authority.*

*The airport shall be operated in accordance with the approved Contour Reduction Scheme subject to any changes approved as part of the annual review and subject to any revision of the Contour Reduction Scheme approved pursuant to this condition.*

*Forecast aircraft movements and consequential noise contours (Day, Night and Quota Periods) for the forthcoming calendar year shall be reported on the 1st December each year to the Local Planning Authority, which shall utilise the standard 92 day summer contour.*